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The Effect of Local Chicken Egg Sanitation on Hatching Performance

Siti Mawaddah[1], Gilang Ayuningtyas[1], Tera Fit Rayani[1], Fitriani Eka Puji Lestari[1]
[1] *Vocational Studies of IPB University Jl. Kumbang No. 14*
Kampus IPB Cilibende 16128, Bogor, Indonesia
Email Correspondence : sitimawaddah@apps.ipb.ac.id
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ABSTRACT. *This study aims to evaluate the effect of local chicken egg sanitation in the hatching process. Various sanitation methods analyzed on fertility, mortality, egg hatch weight, and egg hatchability. The research was conducted in the hatching room of the Vocational School at the Bogor Agricultural Institute, located at Jl. Kumbang No. 14 Babakan, Bogor Tengah, Bogor City, West Java, 9-30 May 2024. The analysis method was descriptive, using three treatments with a total of 99 local chicken eggs (33 eggs per treatment): (P1) dry sanitation (as control), (P2) wet sanitation (commercial food grade cleaner) + Dry sanitation, and (P3) wet sanitation (chemical egg cleaner) + dry sanitation. The active sanitizing ingredients contained in the commercial food-grade cleaner are linear alkylbenzene sulfonate sodium, sodium laureth sulfate, sodium lauryl sulfate, and cocamidopropyl betaine. Meanwhile, the active ingredients contained in chemical egg cleaner are cetylpyridinium chloride, cetyltrimethyl ammonium bromide, and benzalkonium chloride. The result showed that treatment (P2) wet sanitation (commercial food grade cleaner) + dry sanitation showed the best performance compared to treatment (P1) dry sanitation and (P3) wet sanitation (chemical egg cleaner) + dry sanitation.*

Keywords*:egg, hatcability, fertility, sanitation, fumigation*

INTRODUCTION

The development of poultry embryos requires an ideal environment, one of them is the cleanliness of the hatching eggs. Efforts to produce clean (physically and microbiologically) hatching eggs are carried out starting management on breeding farms. For example, providing nest boxes, collecting hatching eggs as often as possible (4-7 times per day), storing hatching eggs in a clean egg tray, and doing physical cleaning on dirty hatching eggs (Ernst *et al*. 2004). These actions do not guarantee the loss of microorganisms on the surface of the hatching eggshell or even those that have penetrated the interior of the egg.

Sanitation is a crucial aspect of the hatching process for local chicken eggs, significantly impacted hatching performance. Clean eggs that are free from microbial contamination have a higher possibility of hatching into healthy, quality chicks. Conversely, eggs contaminated with pathogens such as bacteria, fungi, or viruses can lead to reduce hatchability, increased embryo mortality, and yield weak chicks.

The sanitation process for hatching eggs includes several steps: physical cleaning, the use of appropriate disinfectants, and maintaining a hygienic environment in the hatching area. Each step aims to minimize the risk of infections that could interfere with embryo development and it reduce hatching of productivity. In the hatching process using machines, the cleanliness of both the eggs and the incubator must be emphasized. One critical factor affecting hatching success is the cleanliness of the eggshell, as it can harbor dirt, particularly feces, which are sources of bacteria and fungi that can harm embryos. The cleanliness of the eggs improves when the shells are free from any contamination.

Contamination can occur while the eggs are still within the hen and from exposure to the external environment after the eggs are laid. Before placing hatching eggs into the incubator, it is essential to remove any pathogens adhering to the shells to prevent contamination of the egg contents and the hatching unit (Rasyaf, 1984).

Sanitation eggs and hatching equipment could use various disinfectants. One commonly used disinfectant in the hatching process is formaldehyde. However, high concentration of disinfectants during embryo development can cause abnormalities (Nandhra *et al.* 2014). Formaldehyde produced from the reaction between formalin and potassium permanganate ($KMnO_4$) is a hazardous gas for both developing embryos and humans involved in the incubation process.

The dangers formalin causing irritation, and having carcinogenic and mutagenic properties. $KMnO_4$ is currently not freely available on the market, as it is often misused as a component in the manufacture of explosives. Many studies have attempted to find alternatives to formaldehyde. A study using cherry leaf extract at a concentration of 750 ppm showed the highest hatchability rate of 90.9%, while the lowest hatchability was observed in the control group 75.2% (Ayuningtyas *et al.* 2022).

This study aims to evaluate the effect of sanitation local chickens on the hatching performance. The research will analyze various sanitation methods used and their impacts on fertility, mortality, egg hatch weight, and egg hatchability. The findings are expected to provide practical guidance for farmers in managing the local chicken eggs more effectively and efficiently.

MATERIALS AND METHODS

This research was carried out at the poultry laboratory of Livestock Management and Technology Study Program, The College of Vocational Studies Bogor Agricultural University.

Tools

The tools used in this study included a setter machine, a hatcher machine, three thermohygrometers, one thermogun, three vernier calipers, three digital scales, six water trays, one stainless steel bowl, measuring cylinder, six egg trays, three sponges, two petri dishes, three tweezers, four trays,spone.

Materials

This research used eggs consist of 99 local chicken eggs, formalin, Kalium Permanganat ($KMnO_4$), commercial food grade cleaner and chemical egg cleaner. In treatment 1 egg fumigation was applied, whereas in treatments 2 and 3 no egg fumigation was performed. The treatments were as follows;

P1 : Dry sanitation and fumigations (as control)

P2 : Wet sanitation (commercial food grade cleaner) + Dry sanitation

P3 : Wet sanitation (chemical egg cleaner) + Dry sanitation

Methods

The research was conducted with the following steps:

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1. Preparation of Hatching Machine

The preparation of the incubator machine is necessary to check the stability of the equipment before use. Fumigation performed on the setter and hatcher machines used a fumigant consisting of a mixture of formalin and $KMnO_4$ (kalium permanganate). The ratio used for fumigation was 2:1, or equivalent to 40:20, with the following formula:

$$KMNO_4 = \frac{\text{Mechine Volume } (m^3)}{2.83} \quad \text{20 ml x Formalin dosage}$$

The ratio above is adjusted based on the volume of the machine used. The calculation results for fumigation of the FAI (Force Air Incubator) with a machine volume of 0.346 m^3 in the hatching room of the Vocational college IPB showed that the amount of formalin used is 14,67 ml and $KMnO_4$ amounted to 7.33 grams. $KMnO_4$ was placed in a stainless steel bowl and then stored in the machines. Once placed in the machine, the measured formalin was poured into the bowl, and the machine was sealed for 30 minutes. After fumigation, the machines was powered on and monitored for three days to assess the temperature and humidity conditions. This monitoring was conducted by checking the temperature and humidity on a thermo-hygrometer three times daily. The machines was considered ready for use when the temperature stabilized between 37-39°C and the humidity was >50%.

The first day, the ventilation of machines opened on the right and left sides were closed with paper to help stabilize the temperature and humidity inside. The ventilations were gradually opened one by one. On day 3, one ventilation was opened, and another was opened on the opposite side on day 7.

2. Sanitation of hatching eggs

Before hatching eggs are placed in the machines, efforts are needed to remove any pathogens adhering to the eggshells, to prevent contamination of the egg contents and the hatching unit. In this study, sanitation was carried out using two methods: dry sanitation and wet sanitation. Dry sanitation involved using a dry cloth and wire sponge, while wet sanitation used commercial food grade cleaner and chemical egg cleaner for each treatment.

Research variables

Fertility, Three days after hatching, the percentage of fertilized eggs was calculated by performing candling on the eggs that had been incubated, and then counting the number of Fertilized eggs. Fertilized eggs are identified by the presence of an embryo inside. Fertility is calculated by dividing the number of fertilized eggs by the total number of eggs incubated, then multiplying by 100%.

Hatchability is calculated by dividing the number of eggs that hatch by the number of fertilized eggs.

Hatch eggs weight: Day-Old Quail (DOQ) are not immediately transferred to the growing cages, but are first left in the hatching machine until their feathers are dry. Once the feathers are dry, each bird is weighed individually using a digital scale to determine the hatch weight.

Embryo mortality is the percentage of embryos that die before hatching, calculated based on the number of fertilized eggs. Variables including fertility, hatchability, hatch egg weight, and embryo development were analyzed and described descriptively.

RESULTS AND DISCUSSION

Grading of hatching eggs is an important step to prevent egg spoilage during incubation. Additionally, the quality of the hatching eggs affects the quality of the Day-Old Chick (DOC). This grading process includes several aspects: egg weight, egg index, and shell temperature.

Egg weight is the mass of a single egg. This research used egg local chicken weight between 45–48 grams per egg. The egg weight in this study is categorized as small (<50 g) based on the Indonesian National Standard (SNI) which classifies eggs into three categories: small (<50 g), medium (50 g to 60 g), and large (>60 g) (BSN, 2008). Nishimura *et al*. (2021) reported that genetic factors and chicken strain play an important role in influencing egg weight, yolk color, yolk size, and albumen.

Egg shape index is defined as the ratio of width to length of the egg, and it is an important criteria in determining egg quality (Duman *et al.* 2014). The normal shape index for local chicken hatching eggs is oval, with an egg shape index ranging from 69% to 77% (Zainuddin and Jannah 2014). Eggs are categorized into three types based on their shape index: elongated, normal, and round (Duman *et al.* 2016). Egg weight and egg index measurements are carried out using a scale and caliper. Table one was the table for grading hatching egg quality.

The egg index for P1 ranged from 72.01% to 83.57%, for P2 it ranged from 73.04% to 85.44%, and for P3 it ranged from 70.60% to 82.17%. According to Yuwanta T (2004), a good egg index for hatching eggs is between 70-79%. Dharma *et al*. (2001) stated that the egg shape index is influenced by many factors but is not affected by the embryo's sex. Egg shape is strongly influenced by genetic traits and breed and can also be caused by processes occurring during egg formation, especially when the egg passes through the magnum and isthmus (Elvira *et al*., 1994).

Success in incubation machine is supported by good hatchery management. According to Norma (2021), the optimal incubation temperature for hatching KUB chicken eggs is between 37–38ºC. The optimal humidity for eggs at the beginning of incubation is around 52–55% and near hatching it should be around 60–70% (Paimin 2011). Treatment 2 in table 1 showed that the temperature received by the eggshell is in accordance with the ideal needs of the embryo at 37.23% compared to treatment 1 and 3 which are 36.83% and 36.63%, respectively.

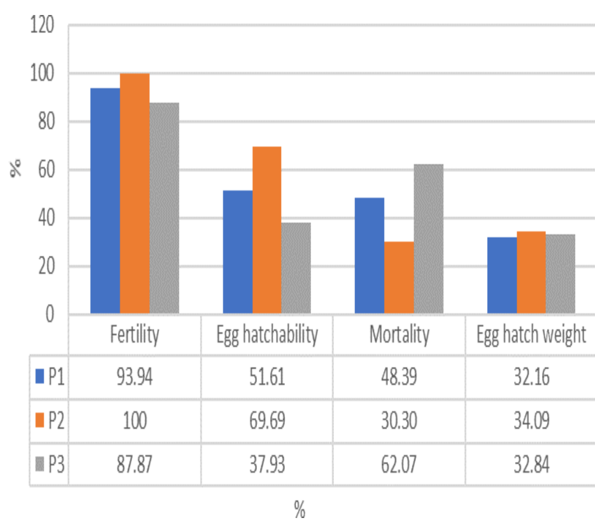
Fertility of hatching eggs refers to the number of fertile eggs out of the total eggs that are incubated or hatched, and is expressed as a percentage (Bell and Weaver, 2002). The factors that determine egg fertility include the quality of the hatching eggs, (Agustira and Risna, 2017). Egg fertility can be evaluated, and also the embryo's egg can be estimated through candling (Samour 2016).

Table 1. Grading of local chicken eggs

Parameter	Treatments		
	P1	P2	P3
Egg weight (g)	47,92 ± 5,57	46,43 ± 3,87	45,31 ± 3,81
Egg index (%)	77,94 ± 3,03	76,96 ± 2,92	76,19 ± 2,82
Shell Temperature (C°)	36,83 ± 1,81	37,23 ± 0,21	36,63 ± 0,92

P1 : Dry sanitation and fumigations (as control)
P2 : Wet sanitation (commercial food grade cleaner) + Dry sanitation
P3 : Wet sanitation (chemical egg cleaner) + Dry sanitation

From the picture 1, the diagram showed that the highest fertility was achieved in the P2 treatment, with a fertility rate of 100%, while the lowest fertility was found in the P3 treatment, with a fertility rate of 87.88%. Fertility levels are not influenced by incubation management but rather by management practices during rearing in the breeding cages, particularly concerning the parent stock. Therefore, optimal management



Picture 1. Hatching Performance

P1 : Dry sanitation and fumigations (as control)
P2 : Wet sanitation (commercial food grade cleaner) + Dry sanitation
P3 : Wet sanitation (chemical egg cleaner) + Dry sanitation

of the parent stock is required, including proper feed nutrition and sex ratio, to improve fertility in hatching eggs.

Hatchability is the percentage of eggs that hatch out of the total number of fertilized eggs that were incubated (Setiadi 2000). According to Biyatmoko (2003 in Suryana, 2008b), the average hatchability rate for Indonesian native chicken eggs is 84.60%. Hatchability can be calculated in two ways: first, by comparing the number of eggs that hatch to the total number of eggs incubated, and second, by comparing the number of eggs that hatch to the number of fertilized (inseminated) eggs. Factors that influence hatchability include conditions at the breeding farm (nutrition provided to the breeders, diseases, infertility, egg damage, and storage) and at the hatchery (hygiene, incubation management, setter machines, and hatcher machines). Based on the hatching performance diagrams it can be concluded that the highest hatchability rate, both for setting and fertile eggs, was achieved by P2 at 69.7%.

Chemical egg cleaner is a disinfectant commonly used in various applications, including in livestock farming, households, and public facilities. chemical egg cleaner is well-known for its effectiveness in killing bacteria, viruses, fungi, and other microorganisms that can cause diseases. chemical egg cleaner typically contains active chemical ingredients such as cetylpyridinium chloride, cetyltrimethyl ammonium bromide, and benzalkonium chloride. This compound is known to be an effective disinfectant because it is capable of destroying the cell membranes of microorganisms. Commercial food grade cleaner is a well-known cleaning product brand, particularly for washing dishes. This product is recognized for its formula that effectively removes fatty and dirt. The active ingredients which contained in commercial food grade cleaner are alkylbenzene sulfonate sodium, sodium laureth sulfate, sodium lauryl sulfate, and cocamidopropyl betaine.

The use of commercial food grade cleaner (P2) shows the highest hatchability rate (69,69%) and the lowest mortality (30,30%) compared to the control (P1) and the use of chemical egg cleaner (P3). This is suspected to be because the dosage used for the chemical egg cleaner is not appropriate for hatching eggs, which causes embryo death.

The hatchability rate achieved was fairly good at 69,69% used commercial food grade cleaner. This is an improvement compared to the study by Iriyanti *et al.* (2007), which reported a hatchability rate of 62.02% for native chicken eggs. The lowest hatchability was observed in the P3 treatment at 30,30% due to prolonged storage which leads to the rupture of the chalaza, the critical structure in the egg. The chalaza serves as the support for the developing embryo and as a separator between the yolk and albumen. Sudjarwo *et al* (2014) explained that eggs stored for more than 10 days tend to have lower hatchability because the chalaza, which separates the yolk and albumen, breaks down, causing the egg contents to become disordered and disturbing embryonic development, thus resulting in lower hatchability. A similar view was expressed by Hartono and Isman (2012), who stated that the chalaza is a key structure in the hatching process.

The weight of hatching eggs is highly dependent on various factors, including the type of poultry, feed, environment, and others (Suprijatna *et al*. 2010). The average hatch weight of this local chicken is higher than the hatch weight of Sentul chicken at 32.2 g (Hidayat and Sopiyana, 2010), and Pelung chicken at 31.83 g (Darwati, 2000). The percentage of hatch weight in the control treatment (P1), P2, and P3 were 67.11%, 73.42%, and 72.47% respectively. This percentage is considered good because the average hatch weight exceeds two-thirds of the average egg weight. A normal hatch weight is two-thirds of the egg weight, and if the hatch weight is less than this the hatching process can be considered unsuccessful (Sudaryani and Santoso, 1999).

CONCLUSION

Based on the results of the native chicken hatching study, it can be concluded that the treatment (P2), which involved dry sanitation and wet sanitation using commercial food grade cleaner showed that the best performance compared to treatment (P1) dry sanitation and fumigations, and (P3) treatment chemical egg cleaner plus dry sanitation.

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