Effect Of Incubation Temperature On Ikta's Quail Breed With New Rolling Mechanism System

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ABSTRACT

Successful of hatching rates in incubation quails IKTA(Institut Kemahiran Ternakan Ayam) may differ between each hatchery. There is numerous factor that influence embryonic development, among the parameter is temperature, humidity, air movement, eggs placement etc., This factor may lead to high percentage of embryo hatching and healthy DOQ (day one quail). Nine incubations were performed with 3 set of different temperature to examine the effect of different setting temperature. For eggs placement, eggs were turns using rolling mechanism 360° for every hour. Eggs obtained from local breeder with same age broiler flocks and stored for 1 to 4 days prior to intimate other commercial ideal condition. All in and all out system was used in all incubation set, eggs were place 40 piece in tray from day one until day 17. Overall it was determined that the best setting temperature is 37°c $_{14day}$ then 38°c $_{3day}$ that can produce average 89.17% hatching, average first hatch is in the end of day 15 complete hatch in 16 day. Temperature set 38°c $_{14day}$, then 39°c$_{3day}$ is 84.17%, average first hatch is day 15.5 end 16 day, not harmful compared to 39°c$_{14day}$, then 40°c$_{3day}$ with 76.67% hatching with average first hatch is day 15.5 end 16 day. With increasing setting temperature, up to 39°c to 40°c still not successful as 37°c to 38°c, excessive temperature did not affect hatchability neither drastically speed up the hatching days, but can cause detrimental effect, embryonic mortality to eggs development. First hatch in the

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end of day 14, average in day 15, complete hatching in the end of day 16 , this is faster than other incubator in the market that average 17 day/ cycle. This new faster cycle cause by the consistent heat flow and humidity inside incubation chamber surrounding the eggs shell. In conclusion, ideal setting temperature 37°c $_{14day}$ 38°c $_{3day}$ is the best setting temperature to incubate IKTA species quails, with the efficiency of machine supply consistence temperature, humidity and eggs movement are the main parameter to ensure high hatching rates of IKTA quails.

Keywords: *Eggs Incubator, IKTA Quails, Eggs placement rolling 360°, Quails Incubation Temperature.*

Introduction

Eggs incubator is an alternative technology to hatch eggs without involving brooding parent, the obvious difference between natural and artificial incubation is natural hen provides heat and environment humidity to the egg with body warmth. Meanwhile incubator uses a set of heater and humidifier to supply sufficient and the ideal setting parameter. The act of turning of avian eggs during incubation affects various physiological and physical aspects of the embryo and extra-embryonic membranes including formation of sub embryonic fluid, utilization of albumen, and embryonic growth. Embryo begins development even before the egg leaves the hen's body and with the optimum environmental factors will continue development. There are numerous factors that influence embryonic development throughout incubation, including environmental temperature, humidity, air movement, and turning of the egg. These factors are altered depending on the number of eggs set, the age of the egg at set, the age of the hen at lay, and the breed of the hen. Turning is one of those factors that can have detrimental and beneficial effects and will be discussed in more detail in this research. Air movement through the incubator is essential for removal of metabolic heat and carbon dioxide from around the egg and turning alters that air movement, causing varying microclimates deviating from set point in the air around some of the eggs. This can lead to a wider hatch window and a variance in chick quality.

Nomenclature

RH	relative humidity
DOQ	day one quail
IKTA	Institut Kemahiran Ternakan Ayam

Research background

This research is to design and develop eggs incubator for incubation of IKTA (Institut Kemahiran Ternakan Ayam) eggs through rolling 360^0 rolling system with different set of temperature setting and then the hatching result will be monitored and compared. IKTA quails is chosen as test subject because of there are no specific research on the best hatching parameter for this new Malaysian quails variety, this IKTA species come from cross bread from Japanese quails and France quails. Figure 1 shows the experimental rig of incubator used in this experiment. This incubator equipped with temperature and humidity sensors to measure and controls the ideal condition in the incubation chamber. Incubator body is fabricated using stainless steels to ensure less bacterial built up and cross contamination between the incubator and the hatched DOQ (day one quail). The user interface designed with user friendly platform to ease change of parameters condition to fit the various types of eggs. Geared motor used to rotate the eggs tray and automatically change the position of egg through rolling 360° .This system also will be equipped with data logging temperature and humidity for data recording and further analysis.

Figure 1: Experimental RIG Incubator

Embryo formation

Embryo formation in egg is a continuous process and could be categorized to three phases that are different namely formation difference, growth and maturity. Usually, embryo formation difference happened on first day process incubation. Growth and embryo maturity happen in embryo formation phase as in Figure 2. Each of this phase need specification and condition that are

certain. When embryo grow, the embryo metabolic rate will increase to be joined with heat production increase produced by the egg [2]. Due to this, embryo natural pattern shows increase ending process incubation. Inside incubator, difference temperature set point need differentiated by where incubator operate [3].

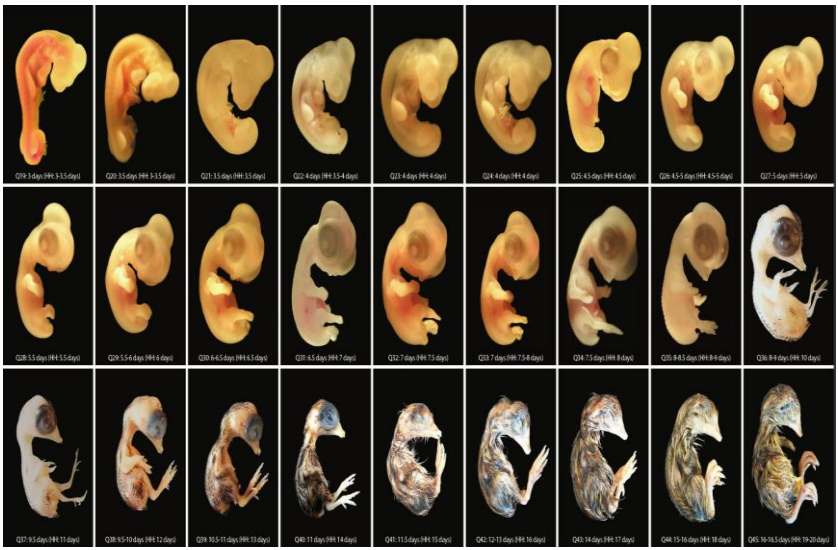


Figure 2: Embryo development of quails [1]

Incubation begin from a process show that embryo produce a little heat and egg must be warmed. This mean that inside temperature incubation machine must be highly from egg temperature, Increasing metabolic heat production increase in line with embryo growth [4]. So, air that surrounded egg need chilled by heat that too hot can be eliminated from egg [5].Water loss in egg will be a common thing during process incubation, between usually 12% to 14% water content [6]. Nevertheless, too low or too high water loss will influence embryo development and egg development [7]. Hatching temperature above optimum point will cause water loss that is excess in egg (higher from 14%), which led to embryonic death due to dehydration [8]. On the other hand, temperature under optimum point will reduce hatchery rate for purpose lowering rate of water loss < 12%, cause gas exchange decline [9].

Rolling 360°

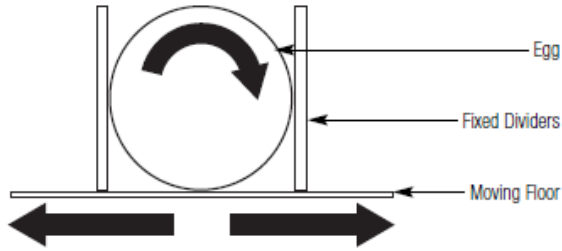


Figure 3: Moving floor type egg turning

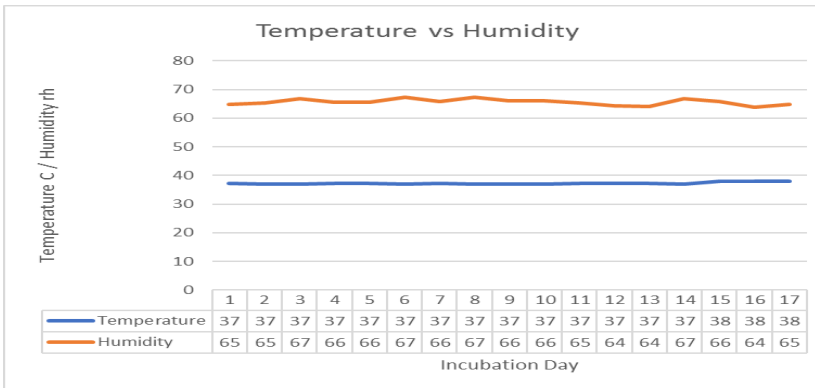
Egg turning method as in Figure 3 widely used in incubation machine that is small scale. Egg place at horizontal condition in where sender floors it moves from side sideways. Egg blocked from side movement with divider still so that egg can roll. This method is very suitable for egg with axis of symmetry from end to end for example quails egg. This turning method is more similar to natural hen brooding, in observation hen will move their eggs using its leg or beak around 96 times per day [11]. hen turn their eggs in a hit-and-miss way as a replacement for certain angle each time. Eggs are set horizontal in the nest [12] and the hen will turn, push, or transfer her eggs up over incubation period, essentially increasing the numbers of eggs placement towards the last few days of incubation [11]. Many of hatcheries tried to combine what the hen does naturally with the innovation and tools to increase efficiency of their incubation system and incubator. Eggs placement around 96 times in a day, shown to be the optimal rate; but, due to higher maintenance cost on the system and incubator, it is distinctive to only turn 24 times in a day [3] confirmed that the increased the number of frequency helps older flocks' hatchability. [4] placement eggs for 6 times daily against 2 times daily and cause heavier embryos in the 1st week of incubation, then this difference vanished throughout the second half of incubation.

Result and Discussion

In this research 9 incubation trials had been done, in each incubation 40 quails eggs were placed on rolling 360° tray inside the incubation chamber refer Figure 4 below.

Figure 4: Eggs placement using 360° rolling mechanism

There are 3 set of setting temperature, first incubation temperature set is 37°c $_{14day}$ 38°c $_{3day}$ for 1st,4th, 7th incubation trials, second incubation temperature set is 38°c $_{14day}$, 39°c$_{3day}$ for 2nd,5th, 8th incubation and the third temperature set is 39°c$_{14day}$, 40°c$_{3day}$ for 3rd,6th,9th incubation. The heat and humidity consistency is shown in Figure 5,6 and 7 below.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Temperature	37	37	37	37	37	37	37	37	37	37	37	37	37	37	38	38	38
Humidity	65	65	67	66	66	67	66	67	66	66	65	64	64	67	66	64	65

Figure 5: 1st incubation parameter set 37°c $_{14day}$ 38°c $_{3day}$ for 1st,4th, 7th Incubation.

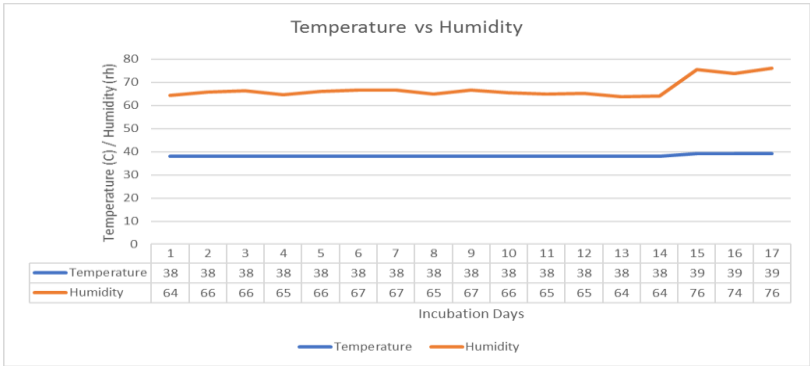


Figure 6: 2nd Incubation parameter set 38°c $_{14day}$, 39°c$_{3day}$ for 2nd,5th, 8th incubation.

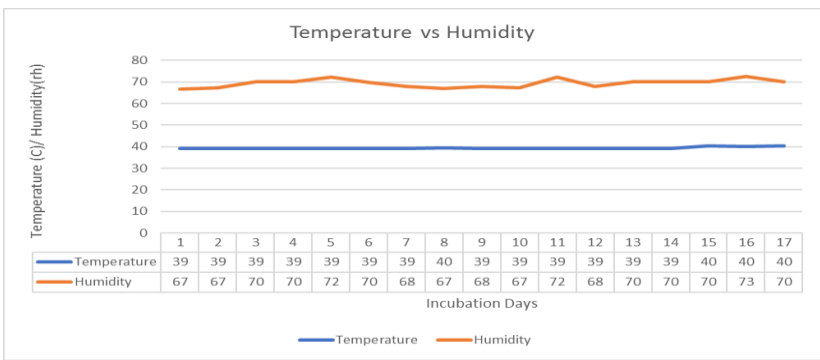


Figure 7: 3rd incubation parameter set 39°c$_{14day}$, 40°c$_{3day}$ for 3rd,6th,9th Incubation.

Table 1 below, show the setting parameter data and the result of eggs hatchability, in the first set incubation cycle, 1st incubation, hatching is 90%, for second incubation temperature adjusted to 38°c $_{14day}$, 39°c$_{3day}$, the hatching shows slightly lower than first incubation of 82.5%, but not as bad of the third incubation, where temperature was increased to 39°c$_{14day}$, 40°c $_{3day}$ and the result show more lower hatching rates 80%. For the second incubation cycle 4th, 5th and 6th incubation, incubator machine produce 87.5%,85% and 80% hatch, where the second set of incubation don't show much different compared to the 1st set of incubation. The third set of incubation 7th, 8th and 9th incubation trials produce 90%,85% and 70% hatch. Through the experiment setting temperature 37°c $_{14day}$ 38°c $_{3day}$ produce 90% hatching in the 1st and 7th incubation trials, that is the highest incubation percentage in all trials where 36 of 40 eggs hatch. The second best temperature is 38°c $_{14day}$, 39°c$_{3day}$ and the worst setting temperature is 39°c$_{14day}$, 40°c $_{3day}$.

Table 1: Hatching result of 9 incubation trials for IKTA quails

Experiment	Days	Temperature	Humidity	No Eggs Move	Number of Eggs	Hatchability Rolling 360°/40
1st Incubation	1-14 Days	37°c	65~75rh	24 times daily	40	90.00%
	15-17Days	38°c	65~75rh			
2nd Incubation	1-14 Days	38°c	65~75rh	24 times daily	40	82.50%
	15-17Days	39°c	65~75rh			
3rd Incubation	1-14 Day	39°c	65~75rh	24 times daily	40	80.00%
	15-17Days	40°c	65~75rh			
4th Incubation	1-14 Day	37°c	65~75rh	24 times daily	40	87.50%
	15-17Days	38°c	65~75rh			
5th Incubation	1-14 Days	38°c	65~75rh	24 times daily	40	85.00%
	15-17Days	39°c	65~75rh			
6th Incubation	1-14 Days	39°c	65~75rh	24 times daily	40	80.00%
	15-17Days	40°c	65~75rh			
7th Incubation	1-14 Day	37°c	65~75rh	24 times daily	40	90.00%
	15-17Days	38°c	65~75rh			
8th Incubation	1-14 Days	38°c	65~75rh	24 times daily	40	85.00%
	15-17Days	39°c	65~75rh			
9th Incubation	1-14 Days	39°c	65~75rh	24 times daily	40	70.00%
	15-17Days	40°c	65~75rh			

Table 2: Average of eggs hatching in 3 difference temperature setting

Experiment	Days	Temperature	Humidity	No Eggs Move	Number of Eggs	Hatchability Average Rolling 360°/40
1st, 4th,7th Incubation	1-14 Days	37°c	65~75rh	24 times daily	40	89.17%
	15-17Days	38°c	65~75rh			
2nd,5th,8th Incubation	1-14 Days	38°c	65~75rh	24 times daily	40	84.17%
	15-17Days	39°c	65~75rh			
3rd, 6th, 9th Incubation	1-14 Day	39°c	65~75rh	24 times daily	40	76.67%
	15-17Days	40°c	65~75rh			

Table 2 indicates the average of eggs hatch for 3 different setting parameter, In the first set is 37°c $_{15day}$ 38°c $_{3day}$ produce 89.17 % hatching compared to 38°c $_{15day}$, 39°c$_{3day}$ average 84.17% and third set, temperature 39°c$_{15day}$, 40°c$_{3day}$ is 76.67% in average. The best incubation temperature with the best hatching rates for IKTA quails is 37°c $_{15day}$ 38°c $_{3day}$ with 89.17%, with this setting

parameter the hatching rates is consistence with good quality and healthy DOQ.

Fig 8: Health DOQ

Fig 9: Abnormal DOQ

Fig 10: Hatch Eggs

The study shows, by rolling the eggs similarly to nature, it can provide proper distribution of albumen, nutrients and oxygen that possible produce higher hatching and reduce production cost. In industry, most of the hatchery observed use slant tray, the eggs rack was stacked very close to each other and block the heat and air flow thus create a hot spot inside the incubation chamber. Good incubator machine has a good ventilation of air movement, this air flow motion is important to the eggs to maintain its humidity, remove CO2 and most important is to improve removal of metabolic heat. This incubator provides lots of advantages such as easy to handle for various kinds of eggs, adjustable partition allows different eggs size to be incubated, vast range of temperature and humidity, portable, affordable, less cross contamination of bacteria, the most important is high hatching ability. In the observation, usually the first hatching occurs in the end of day 14 with smaller size eggs hatches first compared to bigger size. When the DOQ start to make noise, and move around eggs, the other eggs will be stimulated and the hatching activity become more rapid in the 15 days, the remains of the eggs will hatch in day 16, all the DOQ hatches and in a good health without abnormality refer Figure 8 above. Usually the unhatched eggs left is mispositioned eggs where the head position is not under the right wing or more larger eggs that need more time and strength to pipping the eggs shell. In average, all eggs hatches in day 15 and incubation process can be stop in the end of day 16. Compared to industrial practice and in Mr Rahim farm, the average day of hatching is in 16 day and ends in 18 day. Hatching time, in this project quails form IKTA specie takes 14 to 16 day to be hatch. In day 17, the remaining eggs that not hatched after the predicted incubation period should be discarded, during the cracking process don't help quails free from its shell, because the quails that cannot hatch on their own usually cause weaker deformation and cannot use for breeding because of weak traits can be transmitted to their young refer Figure 9 above. When quails hatch it takes great effort and strength to pip and crack the eggs shell, this activity

takes 10 to 20 hours to be complete, the quails need to have good long rest to build up strength to crack entire eggs and free its self. Once quails successfully leave the shell, increase the ventilation in the incubator and leave them about 24 hour until their feather are dry. In figure 10, when all the eggs hatches or reach more than 90 percent of them are dry in the end of day 16, remove from hatcher to a warm brooder farm, give water and feed. The act of leaving the DOQ inside the incubator too long can cause dehydration and death.

Conclusion

With artificial incubation system, natural incubation process can be replicate almost real situation as hen brooding their eggs in nature. With the use of modern technology, the efficiency, accuracy, stability, durability and sustainability can be increased inside the eggs incubator. Thanks to the control system and machine, all 9 incubation trials have high consistency of heat production, humidity, eggs placement and turning duration that contribute considerable influence on the successful of higher eggs hatching. This incubation can maintain a high hatching rate at average of 88%, this is due to the accuracy of the temperature levels, air intake, humidity and eggs rotation frequency. After 9 test run, observation showed that day one quails (DOQ) develop in normal condition and did not suffer from any disability. Consistency in the turning of the eggs will facilitate position of developing embryos and ensure that nutrients are evenly distributed for embryonic development. Current data collected will be studied in greater depth and will be used for future research.

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