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# Effect of Temperature Variation on the Incubation of Hen's Egg

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**Abstract :** *Temperature is the most important of all the physical factors which determine the success of incubation. This experiment was designed to see the effect of different incubation temperatures on egg hatchability and hatchling quality. Two days old fertilised hen eggs were incubated at three different temperatures. Embryo developments were examined after some interval in each group. It has been observed that at low temperature eggs showed slow development in early embryonic days and were rotten after certain period of time. Eggs kept at high temperature showed fast embryonic growth and early hatching of chick with some deformities in the hatchlings. Eggs at constant temperature of 37°C showed normal development and proper hatching. To meet the requirement of the developing embryo in the incubation period a constant temperature in between 37°C-38°C is needed.*

***Keywords :*** *Temperature, Eggs, incubator, embryonic growth.*

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## Introduction:

In recent years, the increasing use of incubators in hatching chickens for the replenishment of poultry flocks has made desirable or more complete knowledge of factors that influence hatching result.

After the eggs are laid, they will not develop until certain conditions or parameters are met. The conditions maybe: Incubation time, Incubation temperature, Humidity (Air Relative Humidity) and Egg positioning &Turning.

The most important of this is temperature. Temperature is one of the physical factors that determine the success of incubation. Therefore, it is essential to determine and use a temperature that promotes the highest hatchability (Swann & Brake, 1990) and the best hatchling quality (Wilson, 1991; Decuypere & Mitchels, *1992*), known as optimum incubation temperature. The effect of incubation temperature on egg hatchability and hatchling quality may be related to its influence on incubation length and water loss during incubation. However, such effects depend on how long and how intense is the shift from optimum temperature. An increase of 1 unit in the hatchability of total eggs, a primary criterion of productivity in breeder farms, converts into a great financial value over time (Ipek et al.,2004). To obtain optimum incubation results, the conditions during incubation must be adjusted to meet the requirements of the embryo (Meijerhof, 2009).

Testing temperature is sometimes unreported or given as a general range, such as room temperature (Keener et al., 2000; Kirunda and McKee, 2000). This could impact results and also makes it difûcult to compare studies.

The present experiment has been designed to see the effect of different temperature variations on the growth of embryo in the hen's eggs in the incubator.

**Materials and Methods:**

Total 30 fertilised eggs were brought from the hatchery and all the eggs were weighed and numbered from 1 to 30. The eggs were then divided into three groups naming A, B, and C containing 10 eggs each. The eggs numbered from 1 to 10 were kept in group A at 30°C, the eggs numbered from 11 to 20 were kept in group B at 39°C and the eggs numbered from 21 to 30 were kept in group C at 37°C each in incubator. After every 3 days eggs were taken group wise and weighed. Temperature variation was provided to group A from 30°C to 33°C, group B from 39°C to 42°C with a variation of 1°C each at an interval of every 3 days and group C was provided with constant temperature of 37°C. Voluntary movements were seen through candling or flashlight. To maintain humidity, 250 ml of water in a beaker was kept inside each incubator. Eggs were rotated daily for about 3-4 times by our own to ensure proper development of chick embryo and also to ensure that there is even heat distribution and so that the embryo doesn't develop while lying on only one side. Measurements were taken at regular intervals of about 3 days till the 18$^{th}$ day of incubation. One egg from each group has been taken out and the development of embryo has been observed by breaking it on the 2nd, 7th, 9th, 12th, 17th, 19th and 21st day, permanent slides were prepared and observed under the microscope. The Comparison of growth of each group has been done by breaking one of the eggs of each incubator and watching the growth of embryos respectively.

## Result and Discussion :

**Table 1. Weight (in grams) of eggs (no. 1 to 10) kept in temperature variation between 30°C to 33°C during different days of incubation**

| Eggs: | 1st | 3rd | 6th | 9th | 12th | 15th | 18th |
|---|---|---|---|---|---|---|---|
| 1 | 74.8 | _____ | _____ | _____ | _____ | _____ | _____ |
| 2 | 69.96 | 69.90 | 65.47 | _____ | _____ | _____ | _____ |
| 3 | 66.5 | 66.49 | 66.46 | 63.78 | broken | _____ | _____ |
| 4 | 67.25 | 67.22 | 63.88 | 60.12 | 52.30 | rotten | _____ |
| 5 | 75.37 | 75.33 | 69.96 | 65.74 | 53.52 | 49.32 | 48.64 |
| 6 | 79.75 | 76.62 | blasted | _____ | _____ | _____ | _____ |
| 7 | 79.41 | 79.40 | 77.40 | broken | _____ | _____ | _____ |
| 8 | 68.63 | 68.60 | 66.36 | 65.31 | 55.31 | rotten | _____ |
| 9 | 68.86 | 68.83 | 64.15 | 61.98 | 61.98 | 60.82 | 60.82 |
| 10 | 77.49 | 77.45 | 74.25 | 72.77 | 62.72 | 59.73 | 59.73 |

The eggs kept at temperature variation of 30°C to 33°C (Table 1) showed early degrading of eggs. The development was normal in first few days. The egg broken on 2nd day was spotted with yolk, a blastoderm and albumen surrounding it. On 3rd day slight change was observed in eggs weight. On 6th day one of the egg was blasted. The eggs were developing slowly. On 9th day one of the egg was rotten (remarkably known as blasting). Till 12th day most of the eggs were rotten or either blasted. Remaining eggs did not hatched properly after 21st day, nothing significant was found.

**Table 2. Weight (in grams) of eggs (no. 11 to 20) kept in temperature variation between 39°C to 42°C during different days of incubation**

| Eggs: | 1st | 3rd | 6th | 9th | 12th | 15th | 18th |
|---|---|---|---|---|---|---|---|
| 11 | 80.42 | _____ | _____ | _____ | _____ | _____ | _____ |
| 12 | 70.90 | 58.90 | 48.93 | _____ | _____ | _____ | _____ |
| 13 | 70.15 | 58.90 | 57.62 | 57.60 | _____ | _____ | _____ |
| 14 | 73.17 | 62.12 | 51.83 | 50.3 | 49.9 | 49.8 | _____ |
| 15 | 78.57 | 65.15 | 53.11 | _____ | _____ | _____ | _____ |
| 16 | 72.92 | 61.05 | 52.90 | 42.60 | 32.57 | 32.54 | 32.52 |
| 17 | 69.69 | 58.18 | 53.18 | 52.18 | 52.15 | 52.25 | 52.10 |
| 18 | 72.62 | 61.02 | 61.02 | 51.02 | 40.82 | 36.70 | 32.30 |
| 19 | 69.12 | 58.12 | 57.12 | 49.12 | 46.68 | 38.43 | 38.41 |
| 20 | 71.93 | 64.10 | 53.10 | 53.10 | 53.20 | 43.00 | 41.71 |

The eggs kept between 39°C to 42°C (Table 2) showed normal growth in earlier few days, after few days the growth rate enhanced. Later some of the eggs were dehydrated due to high temperature. At approx 12 days of development one of the egg was observed with dehydrated mass. The mass of the eggs were decreasing day by day. One of the remaining eggs hatched with abnormality and other two were observed with dehydrated mass.

**Table 3. Weight (in grams) of eggs (no. 21 to 30) kept in constant temperature at 37°C during different days of incubation**

| Eggs: | 1st | 3rd | 6th | 9th | 12th | 15th | 18th |
|---|---|---|---|---|---|---|---|
| 21 | 76.71 | ____ | ____ | _____ | _____ | ____ | ____ |
| 22 | 75.31 | 68.85 | 66.34 | _____ | _____ | ____ | _____ |
| 23 | 81.45 | 75.61 | 73.20 | 73.20 | _____ | ____ | _____ |
| 24 | 69.31 | 64.43 | 62.17 | ____ | _____ | _____ | ____ |
| 25 | 80.77 | 74.64 | 71.97 | 69.73 | 62.70 | 60.60 | 57.80 |
| 26 | 76.64 | 68.12 | 65.02 | 61.30 | 60.30 | 56.05 | ____ |
| 27 | 76.18 | 61.37 | 58.63 | 52.71 | 40.82 | 39.63 | 33.00 |
| 28 | 72.00 | 66.81 | 64.98 | 61.83 | 57.80 | 52.01 | 45.33 |
| 29 | 75.43 | 69.73 | 67.58 | 57.58 | 52.18 | 50.15 | 45.33 |
| 30 | 73.45 | 57.64 | 51.00 | 49.30 | 46.10 | 39.30 | 34.34 |

The eggs kept at constant temperature of 37°C (Table 3) showed proper embryo growth. After eggs wieghed each time at interval of 3 days, some decrease in weight was observed.in the remaining three eggs , two of the eggs hatched in fully grown chick while one of them showed it's growth arrested at 19 days of development.

Studies have shown that incubation conditions influence embryo development (Freeman and Vince, 1974; Decuypere and Mitchels, 1992; Lourens et al., 2005, 2007; Molenaar et al., 2011) , and incubation temperature is one of the most important physical factors influencing embryo development (Decuypere and Mitchels, 1992; Meijerhof, 2000; Lourens , 2001 , Leksrisompong et al., 2007 ; Willemsen et al., 2010.

The eggs kept at low temperature variation of 32°C-33°C, initially the growth of the embryo was normal but after the 9th day, the growth was restricted and the eggs started to rot, probably the embryo was not getting the proper nourishment due to the lack of optimum incubation temperature (Wilson,1991; Decuypere and Mitchels, 1992). The blasting of eggs were seen after 7th day of incubation in some, due to filling of gases and less evaporation. Studies have shown that lower incubation temperatures (35°C) after 14th day slowed embryonic growth and increased the incubation period (Black and Burggren, 2004).

The eggs kept at high temperature variation of 39°C -42°C showed fast embryonic development and early hatching. In some eggs, due to the dehydration of the yolk and high evaporation, growth was arrested.

Some of the eggs hatched earlier between 19 to 21 days and foetus showed some abnormalities like hindlimbs were not properly grown and development of feathers was also less. They died soon after the hatching. Earlier studies have shown that higher incubation temperature (39.5°C) after 14th day accelerated embryonic development and growth (Leksrisompong et al., 2007).

The eggs kept at constant temperature of 37°C showed normal development and proper hatching. The hatchling had normal development of limbs, feathers, beaks and eyes. The hatching process lasted for 4-12 hours before the chick breaks free from the shell. The egg's tooth makes the initial break in the shell. This is referred to as external pipping. The chick as it appears upon freeing itself from the shell was wet and very tired. For the next several hours it remained still and in rest. A few hours later it became dry and fluffy and became extremely active. Egg tooth dried and falloff. Similar studies had been shown by Lourens et al; (2005.).

The weight of the eggs decreased gradually and approximately 1/4th of the original weight was seen at the time of hatching.This may be due to the loss of water during the incubation and consumption of yolk for the growth of embryo.

**Conclusion :**

The present study showed hatching of the hens' eggs needs a constant temperature variation of 36°C-37°C and proper humidity should be maintained. Lower temperature variation can cause blasting of the eggs whereas higher temperature variation causes abnormal growth and early hatching. Weight of the eggs decreased with the increase of time during the incubation period. Consequently, it is important to incubate eggs at a temperature that optimises hatchability, currently defined as being between 37° and 38°C (most often between 37.5°C to 37.8°C).

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