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Embryo Developmental Stages in Japanese Quail (*Coturnix coturnix japonica*) Eggs Incubated at 38°C

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Abstract

A total of twenty seven Japanese quail eggs were incubated at 38°C and were used in monitoring daily egg weight loss as well as gradual embryo metamorphosis into chick. It was observed that the egg weight value before incubation, varied from 8.73 - 12.29g and during incubation between 7.92 and 12.1g, resulting in egg weight loss ranging from 0.09 - 2.55g. Meanwhile, the embryo weight was apparently independent of initial egg weight. Growth on the yolk surface, formation of blood vessels, heart, eye ball and embryo structure were observed on days 1 to 4. Increase in embryo size was evident on day 6 and plumage strips appeared on day 13. On days 14 to 17, the embryo appeared fully grown with the yolk almost used up and the unabsorbed portion gradually withdrawn into the body and on day 18, chicks pipped and emerged. These observations may be useful in providing the required information in *in ovo* study, egg fertility test and quail embryo anatomical study.

Keywords: Quail embryo metamorphosis, incubation period.

Introduction

Domestication of quails started at about the eleventh century, when the Japanese Emperor was cured of tuberculosis after eating quail (Howes, 1964). Today, there are quail strains like *Coturnix coturnix, Coturnix coturnix coturnix and Coturnix coturnix japonica* (Fah 2009). According to Fah (2009), the Japanese quail (*Coturnix coturnix japonica*) originated from Eastern Asia. In 1992, the Asiatic or Japanese quail was introduced into Nigeria by National Veterinary Research Institute, Vom, Plateau State (Musa *et al*., 2007). Since then, a lot of research findings have been reported on quail eggs as well as nutritional requirements and management practices (Adeyina *et al*., 2015; Makinde *et al*., 2015). Yet, little is known about embryo developmental stages hence, this study may be useful in describing the anatomical structure of quail embryo and estimating when an embryo probably stopped developing following unhatched egg break out. The knowledge of quail chick embryo development becomes imperative due to the difficulties in candling incubated quail eggs, necessitating breakout of unhatched eggs to ascertain egg fertility.

Essentially, this study may serve as a guide *in ovo* study, pharmacological operations and introduction of gene expression vectors into specific cell populations.

Materials and Methods

A total of 27 eggs were collected from laying Japanese quails, weighed using digital scale, labelled using permanent ink marker on the shell, stored at room temperature for 24hrs and incubated at 38°C. An egg was removed from the incubator daily at random, reweighed to obtain weight loss and carefully windowed at the broader end. Photographs of the embryo developmental stages were taken using digital camera and eggs without noticeable growth (probably infertile) were discarded. The embryo weight was collected using digital scale on day 14, when the eggs were transferred to the hatchery component of the same incubator till chick emergence.

Results and Discussion

Table 1 shows weight loss of Japanese quail eggs used in the study. The egg windowed on day 12 was the heaviest (12.29 g) followed by those on days 1, 16, 15, 6, 13, 12 and 8 that ranged from 11.57 to 11.17 g. Eggs with the least weight (8.73 and 8.92 g) were used on days 9 and 3. These values were within 8.03 to 11.36 g categorised as small, medium and large eggs by Adeyanju *et al.* (2014).

The eggs used in this study were seemingly moderate in size thus probably measured up to the prerequisite of hatchability. The egg weight loss value was increasing by day, a trend similar to the report of El-Full and Mahmoud (2012) on stored un-incubated quail eggs, except on days 8, 12, 14 and 16 when the values

were apparently distorted. Though the embryo weight value also decreased by day, it did not follow a particular trend which possibly expressed independent relationship between egg weight and chick weight when considering chick yield. This observation perhaps indicated normal metabolic use up of the nutrients contained in the yolk and albumen during embryo development. Therefore, it somewhat buttressed the speculations that egg weight loss is an important parameter for incubation (Adeyanju *et al*., 2014) and could be used to estimate vital gas exchange (Paganelli *et al*., 1978; Rahn *et al*., 1979).

Table 1: Weight loss of Japanese quail eggs incubated at 38^{0}C

Incubation Day	Initial egg weight (g)	Final egg weight (g)	Egg weight Loss (g)	Embryo weight (g)
1	11.71	11.62	0.09	ND
2	12.29	12.1	0.19	ND
3	8.92	8.7	0.22	ND
4	9.67	9.29	0.38	ND
5	9.69	9.26	0.43	ND
6	11.44	10.76	0.68	ND
7	10.56	9.85	0.71	ND
8	11.17	10.59	0.58	ND
9	8.73	7.92	0.81	ND
10	10.34	9.22	1.12	ND
11	10.62	9.39	1.23	ND
12	11.32	10.59	0.73	ND
13	11.35	9.93	1.42	ND
14	9.14	8.3	0.84	3.35
15	11.50	9.53	1.97	3.79
16	11.57	10.36	1.21	7.31
17	10.73	9.11	1.62	5.88
18	9.20	6.65	2.55	Hatching

ND: Not determined

Plates 1 to 18 present the daily embryo development of Japanese quail. On days 1 and 2, growth was observed on the yolk surface and on day 3 network of blood vessels and heart beat was noticeable. On day 4, growth of eye ball was observed and the embryo structure was formed. Gradual increase in the embryo size was noticeable on day 6 with plumage strips appearing on day 13. Growth of feathers, eyes, beak, wings and legs became obvious on day 14 with allantois attaching the yolk to the embryo.

Plate 1: Day 1

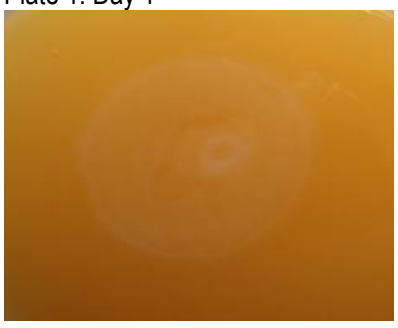


Plate 2: Day 2



Plate 3: Day 3

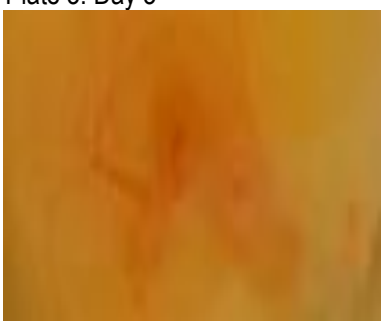


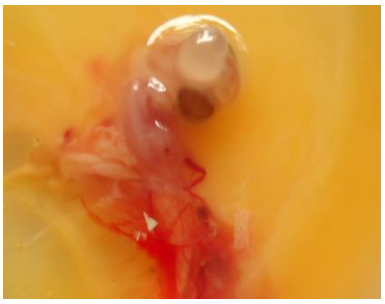
Plate 4: Day 4

Plate 5: Day 5

Plate 6: Day 6


Plate 7: Day 7


Plate 8: Day 8


Plate 9: Day 9

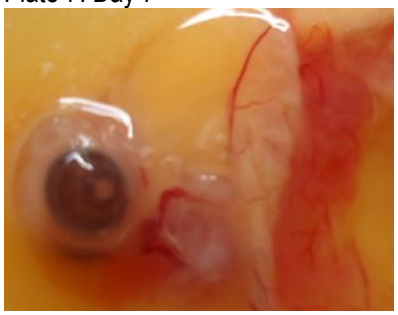

Plate 10: Day 10


Plate 11: Day 11


Plate 12: Day 12


Plate 13: Day 13


Plate 14: Day 14


Plate 15: Day 15

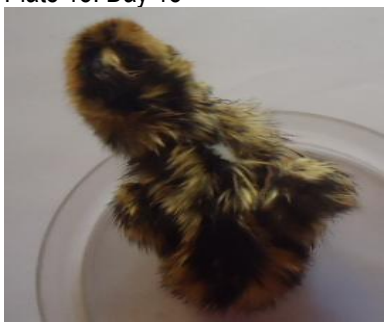

Plate 16: Day 16


Plate 17: Day 17


Plate 18: Day 18







Plates 1 – 18: Daily development of Japanese quail embryo incubated at 38^0C

On days 15, 16 and 17, the embryo appeared fully grown though with attached unabsorbed yolk which was observed to be gradually reducing probably because it was being withdrawn into the body. Chick emergence

was recorded on day 18 corroborating the report of Sellier *et al.* (2006) that quail incubation period varied from 16 to 18 days. The observed disparity possibly depends on the incubation conditions. The observed embryo developmental stages were similar to those reported by Ramteke *et al.* (2013) in quails.

Conclusion

The incubated eggs were seemingly moderate in size, trend of egg weight loss was almost linear, daily embryo developmental stages were gradual and the incubation period was normal. Therefore, this observation could be useful in hatchery operation, because it apparently provides the required information for anatomical description of quail embryo, better egg fertility test and *in ovo* study.

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