An Analysis of Egg Screening: Effect of Frequency on Hatchability, Hatch Weight, and Embryo Mortality of Quail (*Coturnix-coturnix Japonica*)

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ABSTRACT
This study aims to identify and to provide information about the effect of the best egg turning frequency of the best eggs on hatching, hatching weight, and mortality of quail embryos. This research was carried out at Poultry Laboratory, Faculty of Animal Husbandry, Halu Oleo University in Kendari. It used 150 quail eggs. The research method used was a completely randomized design (CRD) with three treatments and five replications, where each treatment was tested for the frequency of egg turning P_1 (Four times/day), P_2 (5 times/day), and P_3 (Six times/day). The variables observed were hatchability, hatching weight, and mortality of quail embryos. The data obtained were then tabulated and analysed using SPSS 15 analysis. The results showed that the frequency of egg turning had a significant effect on embryo mortality and substantially impacted hatchability but it did not have significant effect on hatching weight.

Keywords: *Egg Turning, Quail, Hatchability, Hatch Weight, Embryo Mortality.*

1. INTRODUCTION

Quail is a type of poultry that produces eggs and meat that can be used by human to support the community's need for animal protein, and its feces can be used as fertilizer. Its existence can support the availability of cheap and readily available animal protein. Quail eggs even have a reasonably good protein and fat content compared to other poultries such as chicken and duck. High protein content and low-fat quail egg in quail eggs are very good for human health [1]. Quail (*Coturnix-coturnix japonica*) is known from Japan because it comes from Japan before being bred. This quail originally lives clay in the forest, so it is domesticated/crossed quail (*Coturnix-coturnix japonica*).

Quail has deficient egg production but can incubate the eggs. In this case, the crossed quails have high egg production but have lost the ability to incubate [2]. This led to the regeneration of quail result of crossbreeding which is possible only through the machines' hatchery artificially. In principle, an artificial incubator provides an environment suitable for the embryo's development until the eggs hatch [3]. The hatching process should use eggs of uniform weight. In general, breeder hatching eggs are just put into the incubator without regard to the weight of the eggs during the hatching process, also without regard to the frequency of egg turning. This will make it difficult achieve maximum success in hatching.

The egg selection process can determine the success of hatching until it hatches. A good hatching determines the level of business success of quail seedlings. Selection of egg weight and frequency of egg rotation on embryo viability, hatchability, hatching weight, and DOQ (Day Old Quail) development from the starter period needs special attention.

The irregular egg rotation process can cause the heat hits the egg unevenly so that the embryo will stick to the shell and eventually cause death of the embryo [4]. Screening of eggs must be done at every process of hatching eggs. Turning the egg is done horizontally; that is, the blunt end is always at the top. The function of egg turning is to uniform the surface temperature of the egg, to prevent attachment of the embryo to the embryo shell or eggshell and to prevent the branch of the yolk and allantois at the end of

hatching [5]. Hatching eggs are the initial determinant of quality egg seeds for quail chicks since DOQ (Day Old Quail).

Based on the description that has been explained, the authors are interested in analysing the Effect of Egg Turning Frequency on, Hatchability, Hatching Weight, and Embryo Mortality of Quail (*Coturnix-coturnix japonica*). This study is expected to provide information about the effect of the frequency of turning quail eggs on hatchability, hatching weight, and mortality of quail embryos as a reference for further researches.

2. MATERIALS AND METHODS

This research was carried out from March to April 2020 at the Poultry Animal Cage Unit Laboratory, Faculty of Animal Husbandry, Halu Oleo University Kendari. The equipment used in this study was a manual incubator with a capacity of 150 grains (heating source lamp equipped with a thermostat, manual reversal by hand). The temperature used was 38°C with a humidity of 85%. The other supporting equipment are scale (weighing eggs and DOQ),, candler (egg binoculars), thermometer, plastic trays, and water as a humidity regulator for the incubator. The material used in this study was 150 eggs in 9-month-old quails.

This study used a completely randomized design (CRD) with three treatments, each treatment was repeated five times, and each replication consisted of 10 items. Treatment frequency of quail egg screening that was tried in this study was P_1 = Screening 4 times per day hours (06:00, 12:00, 18:00, 24:00 WITA), P_2 = Screening 5 times per day hours (06 :00, 09:00, 12:00, 15:00, 18:00 WITA) and P_3 = Playing 6 times per day hours (06:00, 10:00, 14:00, 18:00, 22:00, 02:00 WITA). The mathematical model used in this study is as equation (1): [22]

$$Y_{ij} = \mu + \alpha_i + e_{ij} \quad (1)$$

Where,
Y_{ij}: treatment response to-*i* (1, 2, and 3) replicates to-*j* (1, 2, 3 and 4)
μ: general central value
α_i: Effect of treatment on-*i* (frequency of egg turning)
e_{ij}: Effect of treatment errors on-*i* in replay to-*j*

The variables observed in this study were hatchability, hatching weight, and mortality of quail egg embryos which were determined using equations:

$$DT\ (\%) = \frac{JM}{JF} \times 100\% \quad (2)$$

Where: *DT* is Hatchability, *JM* is Number of eggs hatched, *JF* is Number of fertile eggs[23].

Furthermore, calculating the hatching weight (g) was obtained by weighing the weight of the chicks that hatched after the feathers were dry [24]. After that, calculation of the mortality of chickens used the following equation (3).

$$M\ (\%) = \frac{JEM}{JF} \times 100\% \quad (3)$$

Where: *M* is Mortality, *JEM* is Number of dead embryos), *JF is* (Number of fertile eggs.

The data obtained were tabulated and analysed by analysis of variance; if there was a difference between the treatments, it was carried out with the Least Significant Difference (BNT) test.

3. RESULTS AND DISCUSSION

In the world of farming, quail that can be raised comes from *Coturnix-Coturnix japonica*. Quail has excellent potential to be developed and has been known by the community throughout the archipelago by hatching to improve nutrition. Hatching is one way to increase the quail population; the protein content is high, but the fat content is low, so it is very good for health. Quail eggs are quite reasonable when compared to other poultry eggs.

The results of the analysis of observations of fertility, hatchability, hatching weight, and mortality of quail embryos with the frequency of screening is shown in the Table 1. The analysis of variance in Table 1 shows that the percentage of egg turning frequency has a significant effect on hatchability. Hatchability in treatment of egg screening P_1 4 times/day is 2.12% compared to treatment P_2 which is 77.94% screening five times/day and P_3 is 39.78% screening six times/day. It indicates that more frequent the turning of the eggs allows the temperature to be evenly distributed in the eggs to have better

Table 1. Quail Egg Hatchability, Hatching Weight, and Embryo Mortality with different Turning Frequency

Variable	Treatment		
	P_1	P_2	P_3
Hatchability (%)	92,14^a ± 11,41	77,94^b ± 10,80	39,78^c ± 19,92
Hatching weight (gram)	7,31 ± 0,33	7,04 ± 0,25	7,05 ± 0,20
Embryo mortality (%)	7,85 ± 11,41	22,04 ± 10,82	60,22 ± 19,92

Note: Different superscripts on the same line showed a significant effect on treatment ($p < 0.05$).

hatchability. Consistent with the statement [23], screening different eggs should be done at least three times or better rotated up to 5 or 6 times a day and a half rounds. It is added by Hasan *et al.* [25] that a good egg for hatching is an egg that is big nor too small.

The highest egg hatchability is found in the frequency of P_1 (4 times/day) rotation namely (92.1%), and the lowest egg hatchability is found in the P_2 egg rotation frequency (5 times/day), namely (77.94) and P_3 (6 times/day) that is (39.78%). It is because the egg turning is done manually. In addition, it is suspected that the humidity in the incubator is too low so that eggs that already have embryos cannot hatch (die). This statement is reinforced by Rukmana [26] who states that the factors that affect hatchability are technical factors in hatching, both the selection of hatching eggs and egg turning in the incubator. Furthermore, the results of the hatching weight analysis are presented in Table 1.

The results of the analysis of variance in Table 1 shows that the average value of hatching weight and turning frequency does not significantly affect hatching weight. The importance of the quail eggs used in this study is homogeneous, which is 11 grams. Hasan *et al.* [25] added that the greater the egg weight, the greater the DOQ hatching weight produced. Nizar *et al.* [27] state that there is a significant relationship between egg weight and hatching weight because the resulting hatching weight is adjusted to the size of the egg weight. If the egg weight is high, then the hatching weight produced is also high, and vice versa if the egg weight is low, then the hatching weight made is also standard. It is because high weight eggs have a more significant percentage of the composition. It is presumably because the more significant the egg's weight, the more nutrients are there in the egg so that the DOQ produced is also heavier. The next stage, the results of the analysis of egg mortality is shown in Table 1.

The analysis of variance (Table 1) shows that the frequency of screening is highly significant ($P<0.01$) for mortality of embryonic quail eggs. It is because the frequency of excessive egg turning can increase the mortality of quail eggs. It is following Rohmad's study [28], which conducted experiments on quail eggs with the results showing that the frequency of egg turning has a very significant effect ($P<0.01$) on the decrease in mortality of quail eggs. The frequency of regular egg rotation can even out the heat that hits the eggs optimally so that the embryo can grow well. Further, research by Nugraha *et al.* [29] & Rozi et al [30] confirm that dying quail chicks are caused by imperfect egg rotation.

The different test results (BNT) show that P_1 is significantly different from P_2 and P_3 then P_2 is different from P_3. It shows that the frequency of egg turning P_2 (5 times/day) and P_3 (6 times/day) has a significant impact on the high mortality rate of quail embryos. It is suspected that the incubator's temperature is higher, causing the mortality rate of quail eggs at P_3 to be relatively high.

Turning eggs (4 times/day) will reduce mortality in quail eggs to increase hatchability. Paimin [5] states that when the temperature is under normal circumstances, the eggs will hatch a few hours longer than the actual time. Suprijatna [3] adds that the ideal incubator temperature for all hatcheries is relatively the same at 103°F (39.40°C). Temperature and humidity are essential factors for embryonic development or embryo abnormalities, while humidity affects the average growth of the embryo. The temperature and humidity in the incubator must be stable to maintain good egg conditions during the hatching process [31], [32].

4. CONCLUSION

Based on the study results, it can be concluded that egg frequency has an effect on hatchability and embryo mortality but it does not have effect on hatching weight. The frequency of regular egg rotation can even out the heat that hits the eggs optimally so that the embryo can grow well. The best frequency of egg turning for hatching is four times/day.

AUTHORS' CONTRIBUTIONS

Amiludin Indi and Rahim Aka write draft articles; Hasria analysed data.

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REFERENCES

[1] R. Suriani, *Beternak puyuh di pekarangan tanpa bau*. Yogyakarta: Arcitra, 2015.

[2] Suhaimi, "Korelasi bobot telur dengan daya tetas pada puyuh (*coturnix-coturnix japonica*) yang dipelihara secara intensif di Lombok Tengah," Universitas Mataram, 2016.

[3] Suprijatna, *Ilmu Dasar Ternak Unggas Penebar Swadaya*. Jakarta: Penebar Swadaya, 2008.

[4] A. H. Daulay, S. Aris, and A. Salim, "Pengaruh umur dan frekuensi pemutaran terhadap daya tetas dan mortalitas telur ayam Arab (Gallus turticus)," *J. Agribisnis Peternak.*, vol. 1, no. 4, pp. 6–10, 2008.

[5] F. Paimin, *Mesin tetas*. Jakarta: Penebarswadaya, 2011.

[6] H. G. Lase, E. Sujana, and H. Indrijani, "Growth Performance (*Coturnix coturnix japonica*) Laying Quail Brown Crossing Black Feather At Quail Breeding Center University Of Padjadjaran," Bandung, 2016. [Online]. Available: https://journal.unpad.ac.id/ejournal/article/download/10154/4586.

[7] S. frida Jamelah, K. Praseno, and Tyas Rini Saraswati, "Pertumbuhan Puyuh (*Coturnix Coturnix Japonica*) Setelah Pemberian Tepung Kunyit (*Curcuma Longa L.*) Pada Pakan," *Bul. Anat. dan Fisiol.*, vol. 22, no. 2, pp. 12–20, 2014, doi: 10.14710/baf.v22i2.7813.

[8] S. H. Warsito, T. S. Adikara, S. Megasari, I. R. Pratama, M. Lamid, and H. A. Hermadi, "Increasing quantity and internal quality of japanese quail (*Coturnix coturnix japonica*) eggs by shooting laser puncture at reproductive acupuncture points," *Vet. Med. Int.*, vol. 2021, 2021, doi: 10.1155/2021/6621965.

[9] Agromedia, *Puyuh Si Mungil Yang Penuh Potensi*. Jakarta: Agromedia Pustaka, 2002.

[10] D. Narinc, T. Aksoy, E. Karaman, A. Aygun, M. Z. Firat, and M. K. Uslu, "Japanese quail meat quality: Characteristics, heritabilities, and genetic correlations with some slaughter traits," *Poult. Sci.*, vol. 92, no. 7, pp. 1735–1744, 2013, doi: 10.3382/ps.2013-03075.

[11] S. Yalcin, I. Oguz, and S. Otles, "Carcase characteristics of quail (*Cotumix cotumix japonica*) slaughtered at different ages," *Br. Poult. Sci.*, vol. 36, no. 3, pp. 393–399, 1995, doi: 10.1080/00071669508417786.

[12] E. M. Bonos, E. V. Christaki, and P. C. Florou-Paneri, "Performance and carcass characteristics of Japanese quail as affected by sex or mannan oligosaccharides and calcium propionate," *South African J. Anim. Sci.*, vol. 40, no. 3, pp. 173–184, 2010, doi: 10.4314/sajas.v40i3.2.

[13] E. Sujana, A. Anang, I. Setiawan, and T. Widjastuti, "The egg characteristics of malon broiler, Japanese quails and their cross," *Biodiversitas*, vol. 21, no. 3, pp. 889–895, 2020, doi: 10.13057/biodiv/d210306.

[14] T. Yuwanta, *Telur dan Kualitas Telur*. Yogyakarta: Gadjah Mada Universitas Press, 2010.

[15] E. Ri, K. Sato, T. Oikawa, T. Kuneida, and H. Uchida, "Effect of Dietry protein Levels on Production and Charateristic of Japanese Quail Eggs," *J. Poult. Sci.*, vol. 42, no. 1, pp. 130–139, 2005.

[16] A. Sulaeman, L. Lambey, F. Nangoy, and J. Laihad, "Performans Produksi Dan Tebal Kerabang Burung Puyuh Betina(*Coturnix coturnix japonica*) Umur 6-14 Minggu Pada Lama Pencahayaan Yang Berbeda," *J. Zootek*, vol. 38, no. 1, pp. 142–148, 2018.

[17] R. Dewanti, Sudiyono, and Yuhan, "Effect of Eggs Weight and Turning Frequency on Fertility, Hatchability and Hatching Weight of Local Ducks," *Bul. Peternak.*, vol. 38, no. 1, pp. 16–20, 2014.

[18] J. C. M. Eoudia, L. J. Lambey, J. L. P. Saerang, and F. J. Nagoy, "Pengaruh Frekuensi Pemutaran dan Posisi Telur pada Keberhasilan Penetasan Telur Ayam Kampung (*Gallus gallus Domesticus*)," *Zootec*, vol. 39, no. 2, pp. 444–450, 2019.

[19] K. Ismawati and A. Nurhidayat, "Kajian Ekonomi Alih Teknologi Melalui Rekayasa Mesin Penetas Otomatis Ternak Puyuh," *Incontecss*, vol. 1, no. 16 November, pp. 289–294, 2019.

[20] I. N. Sa'diah, D. Garnida, and Andi Mushawwir, "Embryo Mortality And Hatchability of Local Duck (*Anas Sp.*) Based On The Patterns Of Incubator Temperature," *Student E-Journal*, vol. 4, no. 3, pp. 1–11, 2015.

[21] L. Lukman, B. Syamsuryadi, and I. Mutmainna, "Frekuensi Pemutaran Telur Terhadap Nilai Mortalitas, Daya Tetas Dan Bobot Tetas Telur Puyuh," *Agrominansia*, vol. 5, no. 1, pp. 89–97, 2020.

[22] V. Gaspersz, *Metode Perancang percobaan*. Bandung: Armico, 1991.

[23] D. Djannah, *Beternak Ayam*. Surabaya: Yasaguna, 1998.

[24] E. Indrawati, T. Saili, S. Rahadi, and L. O. Nafiu, "Fertilitas, Daya Hidup Embrio, Daya Tetas Dan Bobot Tetas Telur Ayam Ras Hasil Inseminasi Buatan Dengan Ayam Tolaki," *J. Ilmu dan Teknol. Peternak. Trop.*, vol. 2, no. 1, p. 10, 2015, doi: 10.33772/jitro.v2i2.3796.

[25] S. M. Hassan, A. A. Siam, M. E. Mady, and A. L. Cartwright, "Egg storage period and weight effects on hatchability of ostrich (Struthio camelus) eggs," *Poult. Sci.*, vol. 84, no. 12, pp. 1908–1912, 2005, doi: 10.1093/ps/84.12.1908.

[26] Rukmana, *Ayam Buras Intensifikasi dan Kiat Pengembangan*. Yogyakarta: Kanisius, 2003.

[27] F. Nizar, A. Abror, L. Silitonga, and S. Wibowo, "Pengaruh Perbandingan Jantan-Betina dan Lama Penyimpanan Telur Terhadap Daya Tetas Telur Burung Puyuh (Coturnix coturnix japonica)," *J. Ilmu Hewani Trop. (Journal Trop. Anim. Sci.*, vol. 7, no. 1, pp. 2–

4, 2018, [Online]. Available: https://www.unkripjournal.com/index.php/JIHT/article/view/120.

[28] Rohmad and Sofana Fitri, "Pengaruh Frekuensi Pemutaran dan Pembilasan dengan Larutan Desinfektanterhadap Daya Tetas, Mortalitas Dan Bobot Tetas Ayam Arab," *J. Fill. Cendekia*, vol. 1, no. 1, pp. 50–57, 2016.

[29] M. . Nugraha, R. Somanjaya, and D. Widianingrum, "Performa Telur Tetas Burung Puyuh Jepang (*Cocurnix Coturnix Japonica*) Berdasarkan Perbedaan Bobot Telur," *J. Ternak Trop.*, vol. 1, no. 2, pp. 79–80, 2016.

[30] A. F. Rozi, D. Sudrajad, and Anggraeni, "Pengaruh Bentuk Telur Dan Bobot Telur Terhadap Karakteristik Telur Tetas Burung Puyuh (*Coturnix coturnix japonica*) Influence Of Egg Shape And Egg Weight On Characteristic Of Quilted Egg (*Coturnix coturnix japonica*)," *J. Pertan.*, vol. 9, no. April, pp. 43–50, 2018.

[31] D. Darmawati, R. Rukmiasih, and R. Afnan, "Daya Tetas Telur Itik Cihateup dan Alabio," *J. Ilmu Produksi dan Teknol. Has. Peternak.*, vol. 4, no. 1, pp. 257–263, 2016, doi: 10.29244/jipthp.4.1.257-263.

[32] M. S. Okatama, S. Maylinda, and V. . A. Nurgiartiningsih, "Hubungan Bobot Telur dan Indeks Telur dengan Bobot Tetas Itik Dabung di Kabupaten Bangkalan," *J. Trop. Anim. Prod.*, vol. 19, no. 1, pp. 1–8, 2018, doi: 10.21776/ub.jtapro.2018.019.01.1.