Egg production of black and brown Japanese quails raised under battery cage system

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Abstract. The objective of this study was to observe the production traits of black and brown Japanese quails. The materials used were female black and brown Japanese quails originated from two distinct breeding farms. One hundred Japanese quails were divided into four types of line as treatments: Black1 (L1), Brown1 (B1), Black2 (L2), and Brown2 (B2). Each treatment consisted of 25 quails as replication. The experiment used commercial feed for both starter and layer periods. This study used a Completely Randomized Design (CRD). The observed variables were body weight at 42 days, age at first egg, egg weight, and egg production. The data was analyzed with ANOVA, and differences among treatments was inspected using Duncan’s multiple range test (DMRT). Body weight and egg weight were significantly different among lines. Body weight in L2 and B1 populations were higher than L1 and B2 lines ($P<0.05$). In addition, higher egg weight was also found in L2 and B1 lines ($P<0.05$). Age at first egg-laying and egg production were not different among lines. These findings confirmed the presence of high variation among quails. A breeding strategy need to be developed to obtain quails with less diverse genetic background; thus, increase the farms’ management efficiency.

1. Introduction

Quails ($\textit{Coturnix coturnix japonica}$) have been known for their potential as poultry with high egg production. The average quail egg production is around 280-300 eggs/year with egg weights of 10 g/eggs [1]. Quails are recognized as valuable animal models for research because of their short generation intervals, early sexual maturity, low maintenance costs, easy handling, relatively narrow space requirements and are more resistant to various poultry diseases. Quails can begin laying eggs in a short time, which is around 42 days old. Quails also have similarities with several other poultry species so that the quail can be used as experimental animal models in poultry selection research, especially for long-term selection research [2]. Quail is developed in Indonesia is Japanese quail ($\textit{Coturnix coturnix japonica}$) with black and brown feathers [3].

Quail farms are growing rapidly in Indonesia. However, companies specialized in commercial quail breeding or breeding farms as in commercial chicken breeds are yet to exist. Within the area of greater Surakarta region, layer quail farmers bought their final stock from Village Breeding Center (VBC)
managed by groups of breeding farmers. Quail VBCs obtained their breeding stocks from quail lines which currently existed in Indonesia without importing from abroad. These quails were selected based on their phenotype and put it into a breeding program to produce final stocks. The VBCs also exchange their breeding stocks (especially males) to minimize the occurrence of inbreeding.

Livestock production performance is influenced by the genetic background, feed quality and farms’ management. The quails’ genetic quality is one of the determining factors in the success of a livestock business, so the selection of good quality stock is very important. In the VBCs there are two arbitrary selected lines of quails based on their feather colour: the brown and black lines. These lines were created with a sole purpose as a tool to differentiate sexes immediately after hatch. The results of interviews and observations in the preliminary study reported that there has not been a standard or information on the comparison of production performance data between black and brown female quail lines. This study aims to observe the production performance of black and brown layer Japanese quail. This information in important to characterize the production performance among the two breeding lines and to serve improve the breeding strategy.

2. Material and methods

2.1. Material
This study used black and brown female quails and aged 30 days old from two distinct VBCs, the quail farms in Colomadu, Karanganyar (VBC 1) and Cengklik, Boyolali (VBC 2). One hundred Japanese quails were divided into four types of line as treatments: Black1 (L1), Brown1 (B1), Black2 (L2), and Brown2 (B2). Each treatment consisted of 25 quails as replication allotted randomly into individual battery cage. The quails were observed for their production performance until 90 days old. Feed was given in ad libitum. The feed used was commercial quail laying feed. The vaccine used ND La Sota. The vaccine was given through drinking water when the quails were 30 days old. The equipment used were individual battery cages with a length of 25 cm, width 15 cm and height of 25 cm, feed and water container, digital scales (Notebook brand, with 500 grams and 0.01 gram sensitivity), thermo-higrometers, and electric bulbs (40 watts).

2.2. Methods
The cage preparation included cage washing, liming, placing multilevel set cage, and disinfection of the cage along with the feed and drinking place. Disinfection of cages used disinfectants with a dose of 60 mL/10 liters, was carried out three days before quail arrived. Cage equipment such as feed and drink were washed and then soaked for 30 minutes in a disinfectant solution and then dried.

One hundred black and brown quail were divided into 4 line as treatments: Black 1, Brown 1, Black 2, Brown 2, each treatment consisted of 25 quails as replication. Quails were raised in individual cages from age 30 to 90 days. Body weight was measured every week, including at 42 days. The eggs collection and weighing were conducted daily so that data of the age at first egg laying and egg weight could be obtained.

2.3. Research parameters
The parameters observed in the study were body weight at 42 days, age at first egg, egg weight, and egg production.

2.4. Data analysis
Data analysis was done by custom script written in the R programming language. The data obtained were tested for variance analysis or ANOVA ($\alpha=0.05$) in accordance with a completely randomized
design (CRD) with quail lines as the factor. Shall the treatment show significant difference, the Duncan Multiple Range Test or DMRT procedure was applied [4].

3. Results and discussion
The results of egg production performance on black and brown Japanese quail is summarized in Table 1.

Table 1. The average egg production performance on black and brown Japanese quail

| Variable                        | Black 1 (g/bird) | Black 2 (g/bird) | Brown 1 (g/bird) | Brown 2 (g/bird) | P Value |
|---------------------------------|------------------|------------------|------------------|------------------|---------|
| Body weight at 42 days          | 130.75±18.18     | 144.82±12.40     | 143.76±13.77     | 133.60±12.27     | 0.0007  |
| Age at first egg (day)          | 49.28            | 48.44            | 50.12            | 49.68            | -       |
| Egg weight (g/egg)              | 9.33±0.52bc      | 9.96±0.85bc      | 9.65±0.72ab      | 9.23±0.43c       | 0.0005  |
| Egg production (%)              | 62.44±11.90      | 59.00±9.31       | 64.54±10.45      | 59.52±10.72      | 0.22    |

a,b,c: Different superscripts in the same row show very real differences (P<0.05).

3.1. Body weight at 42 days
The body weight at 42 days variable was taken to represent average body weight for quails at sexual maturity or the age average of first egg laying based on existing references. The results of statistical analysis showed that line have very significant effect (P<0.05) on body weight at 42 day. Based on the results of further tests showed the body weight at 42 days was highest on the Black 2 and Brown 1. The Black 2 and Brown 1 lines body weight, however, were not significantly different. The results of the average body weight of Black 2 and Brown 1 at age 42 were higher than the previous finding which were around 100.34 grams/bird [5], 138.91 grams/bird [6] but lower than the average body weight of black quail (181.64 g/bird) and the brown quail (165.58 g/bird) [7]. The body weight has considerable variation depending on the type of animal, sex, age, strain, management, ambient temperature, quality and quantity of feed [8].

3.2. Age at first egg laying
Data on the average age of first egg laying of black and brown quail were summarized and presented in Table 1. The age at first egg laying was fastest in Black 2, followed by Black 1, Brown 2 and the slowest in the Brown 1. This result was in accordance with the previous studies which reported that the age at first egg laying in quails given commercial rations were an average of 47 days [9], 42-56 days [1] and 47.01 days [10].

The results of this study indicate that Black 2, had the age at first egg laying the fastest from other quail line. It was also seen that black quail was relatively faster to eggs laying than brown quail. This shows that there are differences in genetic potential between quails in different colors. This genetic potential difference needs to be considered when designing breeding program for native quails.

3.3. Egg weight
The average weight of black and brown quail eggs from different VBC at the age of 47 days to 90 days had a very significant difference (P<0.05) shown in Table 1. The highest average egg weight was in Black 2 and Brown 1. These results indicate that Black 2 and Brown 1 had similar egg weight. This result was lower than another study which stated that the egg weight of quails were between 10-12 grams [11]. This was due to differences in the age of quail used, in that study used quail aged 7 weeks to 15 weeks. Egg weight increases with increasing age of birds and reaches maximum weight when approaching the end of the egg laying period [8].

The average results of egg weights indicate that quail with the best egg weight on quail farms in Karanganyar was brown quail while at quail farms in Boyolali was black quail. There was a positive
correlation between egg weight data with body weight at 42 days data. This was in accordance with
the opinion that low body weight will produce eggs with low weight, and vice versa [12].

3.4. Egg production

Egg production was defined as the number of eggs produced by a quail in a certain period of time [13].
The average egg production per day (%) of black and brown quail aged 47-90 days was presented in
Table 1. The results showed that there were no significant differences in the variables of quail egg
production. This showed that black and brown quails from one of the farms in Karanganyar and
Boyolali had relatively similar egg production, due to that each quail line had similar genetic potential
because it was still in one type or strain of quail namely Coturnix coturnix japonica. This was in
accordance with the statement that egg production is highly determined including by poultry strains
[8].

The result of the average egg production of black and brown quail was in accordance with the
study which stated that the average egg production per day in quail aged 6-12 weeks (42-84 days) was
61.07% [14]. This result was lower than another study which stated that the average quail egg
production given commercial ration was 67.89% [15], due to the differences in the age of quail used
which were 8-14 weeks (56-98 days). Egg production in the early egg laying period is small and will
increase according to the age increase of quail to reach the peak of production in the 15th week [16].

4. Conclusion

The results of this study concluded that quail stocks from different feather color and origins were
diverse in term of egg production performance; especially in the variables of body weight at 42 days,
egg weight and age at first egg laying. However, the egg production among the lines were relatively
similar.

References
[1] Kaur S, Mandal A B, Singh K B and Kadam M M 2008 Livest. Sci. 117 255–62
[2] Maeda Y, Minvielle F and Okamoto S 1997 J. Poult. Sci. 34 263–72
[3] Tumbilang W, Lambey L, Pudijahustiti E and Tangkere E 2014 Zootek 34 70–184
[4] Steel R G D and Torrie J H 1991 Principle and Procedure of Statistics (Auckland: McGraw-hill
Book Company)
[5] Kahaaruddin D, Kususiyah and Deva 2008 J. Sain Petern. Indones. 3 1–4
[6] Dauda G, Momoh O M, Dim N I and Ogah D M 2014 Egypt. Poult. Sci. 34 381–95
[7] Devi K S, Gupta B R, Prakash M G, Qudratullah S and Reddy A R 2010 J. Vet. Anim. Sci. 6
223–30
[8] North M O and Bell D D 1990 Commercial Chicken Production Manual (New York: Springer)
[9] Masroh F K, Sudjarwo E and Widodo E 2014 Pengaruh Penambahan Tepung Kulit Singkong
Terfermentasi Terhadap Performans Pertumbuhan dan Umur Pertama Bertelur pada Puyuh
(Malang: Faculty of Animal Husbandry Universitas Brawijaya)
[10] Daikwo S I, Dim N I and Momoh O M 2014 J. Agric. Vet. Sci. 7 39–42
[11] Setiawan D 2006 Performa Produksi Burung Puyuh (Coturnix coturnix japonica) pada
Perbandingan Jantan dan Betina yang Berbeda (Bogor: Faculty of Animal Husbandry
Institut Pertanian Bogor)
[12] Lestari E, Ismoyowati and Sukardi 2013 J.I Ilmiah Petern. 1 163–169
[13] Bachari I, Roewandy R and Nasution A 2006 JAI. 2 72–77
[14] The F, Sarajar Ch L K, Montong M E R and Najoan M 2017 Zootek 37 62–69
[15] Ahmadi S E T 2014 Produktivitas Puyuh Petelur Coturnix coturnix japonica yang Diberi
Tepung Daun Jati (Tectona grandis Linn. f.) dalam Ransum (Bogor: Faculty of Animal
Husbandry Institut Pertanian Bogor)
[16] Triyanto 2007 *Performa Produksi Burung Puyuh (Coturnix coturnix japonica) Periode Produksi Umur 6-13 Minggu pada Lama Pencahayaan yang Berbeda* (Bogor: Faculty of Animal Husbandry Institut Pertanian Bogor)