Characteristics of carcass and non-carcass in F1 population crossbred brown and black Japanese quails

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Abstract. The aim of this study was to evaluate characteristics of carcass and non-carcass in F1 population crossbred brown and black Japanese quails. A total of 80 birds have been raised under the same feeding and management in battery cage system. They were divided into four groups based on type of crossing. Brown male quail and Black female quail crossing produced Brown layer lines (BL12 and BL21 lines), on the other hand Black male quail and Brown female quail crossing produced layer populations called LB12 and LB21 lines. The data observed was live body weight, carcass and non-carcass percentages, and abdominal fat percentage. The data was analysed using analysis of variance and if there were pairwise differences among lines Duncan’s multiple range test (DMRT) was performed. Significant differences among lines have been found for live body weight, carcass and non-carcass percentages. Live body weight in LB12 and LB21 populations were significantly higher than others \((P<0.001)\). In addition, highest carcass percentage and lowest non-carcass percentage were found in LB12 population \((P=0.0175\) and \(P=0.0159\), respectively). Abdominal fat percentage was not different among lines. In conclusion, F1 population of LB line had overall better live body weight, carcass and non-carcass percentages than BL lines.

1. Introduction

Japanese quail (\(Coturnix japonica\)) is potential small poultry species to be developed as an animal protein producer due to easy to be raised and it does not need large area in its farming practice. Japanese quail is commonly raised not only to produce egg but also to produce meat in some countries [1]. It has most carcass percentage to be utilized for human consumption among domesticated poultry species [2]. In Indonesia, most of unproductive female quails will be culled out to be slaughtered due to economically unprofitable, on the other hand male quail is intentionally raised to produce meat [3].

Dressed poultry carcass, dead poultry body after being partially butchered without internal organs, head, and legs, is a kind of poultry performances which is affected by both genetic and environment factors such as age of animal, sex, line, and livestock management [4]. Meat quail with excellent dressed carcass characteristics could be produced by crossbred quails genetically superior for meat producer. Genetic potential of quails can be evaluated if they are maintained under the identical condition and management [5].

There are two lines of Japanese quail commonly found in small-holder farmers in Indonesia, i.e. Black plumage and brown plumage lines [6]. Different quail lines developed from different regions may perform different carcass and non-carcass traits. To date, report regarding carcass and non-carcass characteristics of different Japanese quail lines in Indonesia is not previously found. Farmers raises their
quails without scientific knowledge and only based on their field experiences, therefore developing quail with superior traits of interest including carcass and non-carcass characteristics becomes very important. A way to create superior quail lines for meat and carcass traits is by crossing among lines. The objective of present study was to evaluate live body weight, dressed carcass percentage, non-carcass percentage, and abdominal fat percentage of four $F_1$ population crossbred brown and black Japanese quails.

2. Materials and methods

2.1. Quail population and management

A total of 80 heads of Japanese quail have been used in this study. They were constructed by four different crossings. They were 20 heads of crossbred Brown male quail 1 and Black female quail 2 (BL12), 20 heads of crossbred Black male quail 1 and Brown female quail 2 (LB12), 20 heads of crossbred Brown male quail 2 and Black female quail 1 (BL21), and 20 heads of crossbred Black male quail 2 and Brown female quail 1 (LB21). Day old quails (DOQs) were weighed after their plumages were dried, and they were placed into brooder cage. The DOQ was fed by commercial BR1 containing 22% crude protein and 3100 kcal energy metabolism (PT. Wonokoyo Jaya Corporindo, Indonesia) for 30 days of age. Quails were transferred to colony cage (50 x 30 x 20 cm) and each colony cage was occupied by five quails. Furthermore, they were fed by commercial feed for laying quail containing 20% crude protein and 2900 kcal energy metabolism (PT. Japfa Comfeed Indonesia, Indonesia). The quantity and nutrient content of feed given to quail were following Shanaway [7]. All quails were free to access water (ad libitum). In addition, they were vaccinated with ND La Sota at 30 days of age and Vitastress was given to quails every week where the dose was given according to company procedure (PT. Medion Farma Jaya, Indonesia). They were exposed by sunlight for about 12 hours and dim light was applied at night to prevent rodent and other animal attacks using bulbs.

2.2. Slaughtering and carcass traits of $F_1$ population Crossbred Brown and Black Japanese quail

All quails have been fasted for 3.5 to 4 hours and they were weighed using digital weighing scale (Notebook Digital Scale, Indonesia) before slaughtered. Moreover, they were slaughtered by following Islamic law and carcass parts were processed according to procedure developed by Genchev and Mihaylov [8]. Whole dressed carcass and carcass parts have been weighed with Notebook Digital Scale. Data collected in this study were live body weight, carcass traits, non-carcass traits, abdominal fat percentage. Carcass, non-carcass traits and their parts have been measured by following formulas [9,10]:

\[
\text{Carcass Percentage} \% = \frac{\text{Carcass Weight (g)}}{\text{Live Weight (g)}} \times 100\%
\]

\[
\text{Non-carcass Percentage} \% = \frac{\text{Non-carcass Weight (g)}}{\text{Live Weight (g)}} \times 100\%
\]

\[
\text{Abdominal Fat Percentage} \% = \frac{\text{Abdominal Fat Weight (g)}}{\text{Live Weight (g)}} \times 100\%
\]

2.3. Statistical analysis

The data observed in this study was analyzed using analysis of variance (ANOVA) and the alpha was set at 5%. In addition, Duncan’s Multiple Range Test (DMRT) was performed to distinguish among quail populations [11]. Mathematical model used in this study is as follows:

\[
Y_{ij} = \mu + T_i + \varepsilon_{ij}
\]

$Y_{ij}$ is the observed value at $i^{th}$ crossing and $j^{th}$ replicate, $\mu$ is overall mean, $T_i$ is the effect of $i^{th}$ crossing, $\varepsilon_{ij}$ is random error.
3. Results and discussion

3.1. Live body weight
Live body weights of each Japanese quail line in this study is presented in Table 1. Live body weight of crossbred black male quail and brown female quail (LB lines) was significantly higher than crossbred brown male quail and black female quail (BL lines) \( (P<0.01) \). The LB quail lines were 8 to 14 grams higher than BL quail populations. This result indicated that LB lines is genetically more potential to be developed as meat-type quail than BL lines. Crossing between quail lines generates genetically different quail that may affect quantitative traits [2,12]. Previous study also explained that live body weight significantly affected by genetic factor [4]. Lotfi et al. [13] approved that genetic factor contributed greatly to live body weight in quail which is indicated by high heritability value \( (h^2) \) for live body weight. The \( h^2 \) value of live body weight is 0.45 that means 45% of body weight traits in quail inherited by parents to their offspring. In addition, live body weight of quail population in this study is quite similar with previous study reported by Al-Kafajy et al. [14].

3.2. Carcass traits
Carcass percentage and its parts are presented in Table 1. Crossing affected carcass parts of Japanese quail significantly \( (P<0.05) \). Average values of carcass percentage, breast, wings, back, and thighs in LB12 line population were found higher than both LB21 and BL12 lines, however there was no differences with BL21 line. Comparing with previous study, these results were relatively lower where carcass percentage of mature quail can reach up to 67.19% [2]. Genetic and environment condition may greatly contribute to this difference. Moreover, live body weight may directly affect carcass percentage. Higher body weight of quail produces higher dressed carcass weight and carcass percentage [2,15].

| Traits               | BL12          | LB12         | BL21          | LB21          | P-value |
|----------------------|---------------|--------------|---------------|---------------|---------|
| Live weight (g)      | 144.92±10.25b | 152.97±8.95a | 144.81±14.11b | 159.58±9.79a  |<0.001   |
| Carcass (%)          | 55.73±4.22b  | 58.86±2.49a  | 57.04±3.61ab  | 55.88±3.07b   | 0.018   |
| Breast (g)           | 35.23±3.74b  | 37.89±3.08a  | 34.9±4.5b     | 38.25±3.62a   | 0.007   |
| Wings (g)            | 8.35±0.81b   | 9.16±0.99a   | 8.82±1.00ab   | 9.35±1.00a    | 0.009   |
| Back (g)             | 15.29±2.17b  | 18.55±1.68a  | 16.46±1.78b   | 18.38±4.42a   |<0.001   |
| Thigh (g)            | 12.48±1.25b  | 14.36±2.29a  | 12.75±1.87b   | 13.22±1.3ab   | 0.005   |
| Drumstick (g)        | 9.36±1.13    | 10.06±1.34   | 9.55±1.08     | 10.03±1.05    | 0.118   |
| Non carcass (%)      | 37.49±4.29a  | 34.32±3.26b  | 35.43±3.43ab  | 37.22±2.92a   | 0.016   |
| Head (g)             | 6.84±0.54b   | 7.49±0.43a   | 7.09±0.48b    | 7.74±0.59a    |<0.001   |
| Neck (g)             | 4.24±0.49a   | 4.43±0.46a   | 3.92±0.46b    | 4.41±0.45a    | 0.003   |
| Shank (g)            | 3.17±0.31a   | 3.23±0.31a   | 2.95±0.23b    | 3.3±0.3a      | 0.001   |
| Heart (g)            | 1.22±0.24    | 1.27±0.23    | 1.09±0.19     | 1.14±0.27     | 0.080   |
| Liver (g)            | 4.76±0.55b   | 4.41±0.43c   | 4.62±0.51bc   | 5.29±0.54a    |<0.001   |
| Gizzard (g)          | 3.51±0.4a    | 3.93±0.4b    | 3.82±0.63bc   | 4.4±0.7a      |<0.001   |
| Intestine (g)        | 5.63±0.84b   | 5.81±0.7b    | 5.87±0.74b    | 6.59±0.87a    | 0.002   |
| Abdominal fat (%)    | 0.25±0.15    | 0.19±0.08    | 0.25±0.14     | 0.24±0.06     | 0.134   |

\(^{a,b,c}\) superscript on the same line shows significant different \( (P<0.05) \).
3.3. Non-carcass traits
Profile of non-carcass traits produced by four lines of Japanese quail is presented in Table 1. Non carcass percentages of BL12 and LB21 lines were significantly higher than LB12 line, and yet they were statistically not different with BL21 line. Non-carcass components were also significantly different among quail lines. This result was much higher than previous study where non-carcass percentage of Japanese quail was about 26 to 32% [2]. Higher non-carcass percentage is tightly correlated with lower carcass percentage and vice versa since they are negatively correlated [15]. The LB12 population have overall better carcass and non-carcass traits compared to other quail lines.

3.4. Abdominal fat percentage
The difference of abdominal fat percentage among quail lines was not found in this present study (Table 1). It may be due to quails raised under similar environment conditions that may contribute to similar abdominal fat percentage. Tumuva and Teimouri [16] explained that abdominal fat percentage in poultry was affected by slaughtering age, sex, nutrient contents and feed consumption. In addition, sex and the amount of feed given to quail greatly affect abdominal fat deposition [17,18].

4. Conclusion
In conclusion, crossbred Black male and Brown female quails was better in live body weight, carcass and non-carcass traits than crossbred Brown male and Black female quails. It could be considered for quail breeding program and strategy to create meat-type Japanese quail.

Acknowledgements
This study was fully funded by the Institute for Research and Community Service, Universitas Sebelas Maret and a part of research scheme “Hibah Penelitian Unggulan (PU-UNS)” with contract number: 516/UN27.21/PP/2019.

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