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## #57571 Summary

Submission

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Title and Abstract

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# Growth Patterns, Body Weight, and Morphometric of KUB Chicken, Sentul Chicken and Arab Chicken

## Pola Pertumbuhan Bobot Badan dan Morfometrik Ayam KUB, Ayam Sentul dan Ayam Arab

### ABSTRACT

The purpose of this research was to determine the body weight, weight gain and morphometric characteristics of several local chicken strains. The research materials were KUB chicken, Sentul chicken, and Arab chicken. The method used was an experiment with a sample of 82 chickens from each strain. Data collected include body weight, weight gain, beak length, beak width, head length, head circumference, head height, neck length, neck circumference, wing length, back length, back height, chest length, chest width, shank length, shank circumference, tibia length, tibia circumference, third finger length, and pubic bone distance. Data collected were analyzed using the average difference test (t-test). The average value vector of body measurements of chicken lines was analyzed using the T2-~~Hotelling~~ (atau ~~Hotteling~~ diseragamkan) statistical test. Main Component Analysis statistical test was used to identify the shape and size characteristics of each chicken strain. The results showed that the body weight and morphometrics of KUB chickens at 3 months were significantly different ( $P < 0.05$ ) with Sentul chickens and Arab chickens. KUB chicken's body weight gain at 3 months was not significantly different ( $P > 0.05$ ) from Sentul chickens, but it was significantly different ( $P < 0.05$ ) from Arab chickens. Body weight, weight gain, and morphometrics of KUB chickens ~~are were~~ better than Sentul chickens and Arab chickens. The size indicator in KUB chickens ~~is was~~ the tibia length while in Sentul chickens and Arab chickens ~~was ere~~ chest length. The characteristic of KUB chickens ~~is was~~ the back length, Sentul chickens ~~is was~~ tibia length, and Arab chickens ~~is was~~ the shank circumference.

**Keywords:** Body weight, ~~Increased body~~ Weight gain, Body measures, KUB chicken, Sentul chicken, Arab chicken

### INTISARI

Tujuan penelitian ini untuk mengetahui bobot badan dan karakteristik morfometrik beberapa galur ayam lokal. Materi penelitian ini adalah ayam KUB, ayam Sentul, dan ayam Arab. Metode yang digunakan adalah eksperimen dengan jumlah sampel 82 ekor ayam dari masing-masing galur. Data yang dihimpun meliputi: bobot badan, pertambahan bobot badan, panjang paruh, lebar paruh, panjang kepala, lingkaran kepala, tinggi kepala, panjang leher, lingkaran leher, panjang sayap,

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1 panjang punggung, tinggi punggung, panjang dada, lebar dada, panjang *shank*, lingkar shank,  
2 panjang tibia, lingkar tibia, panjang jari terpanjang dan jarak tulang pubis. Data yang telah  
3 dikumpulkan dianalisis menggunakan uji beda rata-rata (uji-t). Vektor nilai rata-rata ukuran-ukuran  
4 tubuh galur ayam dianalisis menggunakan uji statistik  $T^2$ -Hotelling. Uji statistik Analisis Komponen  
5 Utama untuk mengidentifikasi penciri bentuk dan ukuran tubuh pada masing-masing galur ayam.  
6 Hasil penelitian menunjukkan bahwa bobot badan dan morfometrik ayam KUB pada umur 3 bulan  
7 berbeda nyata ( $P<0,05$ ) dengan ayam Sentul maupun ayam Arab. Pertambahan bobot badan  
8 ayam KUB pada umur 3 bulan berbeda tidak nyata ( $P>0,05$ ) dengan ayam Sentul, namun berbeda  
9 nyata ( $P<0,05$ ) dengan ayam Arab. Bobot badan, pertambahan bobot badan, dan morfometrik  
10 ayam KUB lebih baik dibandingkan ayam Sentul dan ayam Arab. Penciri ukuran pada ayam KUB  
11 adalah panjang tibia sedangkan pada ayam Sentul dan ayam Arab adalah panjang dada. Penciri  
12 bentuk ayam KUB adalah panjang punggung, pada ayam Sentul adalah panjang tibia, dan pada  
13 ayam Arab adalah lingkar shank.

14 Kata kunci: Bobot badan, Pertambahan bobot badan, Ukuran-ukuran tubuh, Ayam KUB, Ayam  
15 Sentul, Ayam Arab

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## Introduction

Indonesia is one of the countries with the most population, so the availability of both plant and animal food is very much needed. One of the livestock that can be used as a source of animal protein is chicken. Chicken is one of the livestock that is often raised by the people of Indonesia and provides a large enough role in meeting the needs of the animal protein community. Indonesia has dozens of strains of chicken that have the potential to be developed, one of which is local chicken. Local chickens are very well known by the people of Indonesia because of their very wide distribution area. Among the many local chickens in Indonesia, several strains that are tried to be developed are Sentul chickens, KUB chickens (Kampung Unggul Balitnak), and Arab chickens.

KUB chicken is the Superior Kampung chicken of the Indonesian Agency for Agricultural Research and Development which is the result of selection from a native chicken family for 6 generations (Hidayah *et al.*, 2019). KUB chickens are raised to produce eggs and meat production. KUB chickens have promising prospects both economically and socially because it can supply the needs of highly nutritious food and have the absorption capacity of local and regional markets (Suryana, 2017).

Sentul chicken is one type of local chicken in Indonesia that has been recognized as germplasm of Ciamis Regency through Minister of Agriculture Decree No. 689/Kpts.PD41/ 2/2013 concerning the Determination of Sentul Chickens Clumps as Indonesian Local Clumps from Ciamis (Menteri Pertanian, 2013). Sentul chicken has the potential to be developed as meat and egg-producing chicken because it has good performance in terms of productivity.

Arab chickens originating from Belgium are also called *Kriel Braekels* which are included in the superior laying hens in Belgium. Arabic chicken is one of the native chickens that have been adapted in Indonesia (Gunawan *et al.*, 2018). Arab chickens initially received less attention from breeders, but now Arab chickens have begun to be developed and increased in production. Arab chicken is one type of egg-producing chicken that is quite potential because of its high egg

1 production resembling the productivity of laying hens. Arabian chickens are superior laying hens  
2 classified as light type chickens with a body weight of 40 weeks reaching 2.035g (Indra *et al.*,  
3 2013).

4 Information about KUB chickens, Sentul chickens, and Arab chickens are not widely  
5 known, especially regarding their genetic potential. Genetic information is needed to determine  
6 the genetic quality of livestock which will be used as a material consideration in the selection and  
7 crossbreeding of local chickens in the future. Efforts can be made to obtain basic information about  
8 the genetic quality of livestock, it is necessary to do morphometric characterization of KUB  
9 chickens, Sentul chickens, and Arab chickens.

10 Morphometrics is a quantitative data collection activity that can be used to determine the  
11 level of livestock productivity, identification, and determinants of the characteristics of livestock  
12 which includes size and shape. Morphometric characteristics can be described by femur length,  
13 tibia length, maxilla length, wing length, tarsometatarsus length, tarsometatarsus circumference,  
14 third finger length (middle), and sternum length (Ashifudin *et al.*, 2017). Each type of chicken has  
15 unique characteristics both in size and body shape. Body measurements can be used to study  
16 animal growth and development. Morphometric measurements can also help the process of  
17 selection and crossbreeding between nations and types (Kumianto *et al.*, 2013). The importance  
18 of this research is due to the lack of knowledge about morphometrics, especially in KUB chickens,  
19 Sentul chickens, and Arab chickens which can later be used as basic information for the  
20 development of local chickens in the future.

21

## 22 **Materials and Methods**

23 The research material is KUB chickens, Sentul chickens, and Arab chickens that are kept  
24 from the age of DOC until the age of 3 months. The equipment used is a digital caliper, digital  
25 scales capacity of 3 kg with an accuracy of 0.01 grams, measuring tape, digital cameras,

1 stationery, 1 unit cage, place of feed and drink, commercial feed and drinking water, vaccines,  
2 and medicines.

3 The method used in this study was an experiment on body measurements and body weight of  
4 KUB chickens, Sentul chickens and Arabic chickens. The number of samples was 82 tails from each  
5 chicken strain that was kept from the age of DOC until the age of 3 months. The Chicken breeding  
6 system in a colony cage where each strain is placed in a different cage with other strains. The size of  
7 the cage used is 4 x 3 x 1.8 cm which is equipped with a place to feed, drink, and lighting. Feeding and  
8 drinking are done continuously (*ad libitum*). Measurement of body measurements and body weight is  
9 done every month and every chicken that is measured is marked on the wings. Data collected includes  
10 body weight (BW), weight gain (WG), and morphometrics of chickens. Variables measured include beak  
11 length (BL), beak width (BW), head length (HL), head circumference (HC), head height (HH, neck length  
12 (NL), neck circumference (NC), wing length (WL), back length (BL), back height (BH), chest length (CL),  
13 chest width (CW), shank length (SL), shank circumference (SC), tibia length (TL), tibia circle (TC), third  
14 finger length (TFL) and pubic bone distance (PBD).

15 Data that has been collected include body weight and body measurements grouped by  
16 sex, then corrected to male measurements. then analyzed using the average difference test (t-  
17 test). The average value vector of the two sex groups includes BL, BW, HL, HC, HH, NL, NC, WL,  
18 BL, BH, CL, CW, SL, SC, TL, TC, TFL, PBD were analyzed using the  $T^2$ -Hotelling statistical test.  
19 Then do the statistical test to identify determinants of body shape and size in chickens using  
20 Principal Component Analysis (PCA) (Gaspersz, 2006). Data processing is assisted by using  
21 Minitab statistical software version 18.

22

## Results and Discussion

### Local chicken body weight DOC-3 months

The average body weight of KUB chickens, Sentul chickens, and Arab chickens aged DOC up to 3 months are presented in Table 1.

Based on Table 1 it can be seen that the average body weight of 3 months in KUB chickens is  $1108.42 \pm 84.52$  g, in Sentul chickens is  $1021.44 \pm 100.42$  g, while in Arab chickens is  $874.57 \pm 74.21$  g. The average body weight of KUB chickens in this study is higher than the results of Suryana (2017) research which states the average body weight of KUB chickens at 3 months is 750 g. The average body weight of Sentul chickens in this study was higher than Kurnia's (2011) research which was 532.1 g. However, the average body weight of Sentul chickens in this study is lower than Habiburahman *et al.* (2018) research in Pelung Sentul crossbreed chickens at 3 months of age is 1193.9 gr. The average body weight of Arab chickens in this study is higher than Nataamijaya *et al.* (2003) research with an average of 700 gr. This difference in results is thought to be due to genetic, environmental, and maintenance management differences. This is in accordance with the statement of Subekti and Arlina (2011) which states that differences in body size of chickens can be caused by different environmental conditions of the origin of the seeds and different maintenance environments, as well as genetic factors.

The results of the average difference test (t-test) showed that the DOC KUB chickens weight was not significantly different ( $P>0.05$ ) with Sentul chickens or Arab chickens, as well as Sentul chickens not significantly different ( $P>0.05$ ) with Arab chickens. Body weight at 1 month of age KUB chickens was significantly different ( $P<0.05$ ) with Sentul chickens and Arab chickens, while Sentul chickens body weight was not significantly different ( $P>0.05$ ) from Arab chickens. This is due to variations in the rate of growth between individuals in the form of slow growth at the beginning of the week which then increases at the end of maintenance. At 2 months KUB chickens were significantly different ( $P<0.05$ ) from Sentul chickens and Arab chickens, as well as Sentul



1 chickens body weight significantly different ( $P<0.05$ ) from Arab chickens. Body weight at 3 months  
2 showed that KUB chickens were significantly different ( $P<0.05$ ) from Sentul chickens and Arab  
3 chickens, as well as Sentul chickens significantly different ( $P<0.05$ ) from Arab chickens. Based on  
4 Table 1 it can be seen that the highest body weight at DOC age, 1 month, 2 months and 3 months  
5 is KUB chickens, while the lowest body weight is Arab chickens, it can be stated that KUB chicken  
6 has a higher body weight than Sentul chickens and Arab chickens.

7

#### 8 **Weight gain of local chicken**

9 The weight gain of KUB chickens, Sentul chickens, and Arab chickens at the age of DOC  
10 – 3 months are presented in Figure 1.

11 Based on the different tests the average body weight gain of DOC KUB chickens was not  
12 significantly different ( $P>0.05$ ) with Sentul chickens and with Arab chickens. The weight gain of 1  
13 - 2 months KUB chickens were significantly different ( $P<0.05$ ) with Sentul chickens and Arab  
14 chickens, as well as Sentul chickens body weight gain was significantly different ( $P<0.05$ ) with  
15 Arab chicken. Body weight gain of 2 - 3 months KUB chickens were not significantly different  
16 ( $P>0.05$ ) with Sentul chickens but significantly different ( $P<0.05$ ) from Arab chickens, while Sentul  
17 chickens body weight gain was significantly different ( $P<0.05$ ) with Arab chickens.

18 Figure 1 shows that the average weight gain of KUB chickens, Sentul chickens, and Arab  
19 chickens from DOC - 3 months of age in a row are KUB chickens was  $201.44 \pm 37.92$  g,  $477.51 \pm$   
20  $56.75$  g, and  $395.27 \pm 103.09$  g. The average weight gain of Sentul chickens was  $183.21 \pm 42.91$   
21 g,  $415.82 \pm 95.84$  g, and  $388.57 \pm 100.39$  g. While the average body weight gain of Arab chickens  
22 was  $177.04 \pm 36.55$  g,  $380.70 \pm 53.15$  g, and  $283.37 \pm 80.58$  g. The weight gain of KUB chickens,  
23 Sentul chickens, and Arab chickens continue to increase or grow rapidly at the age of 1 - 2 months  
24 and decrease at the age of 2 - 3 months. This is in line with the opinion of Urfa *et al.* (2017) which  
25 states the growth of chicken body weight will be fast and reach a specific weight at a young age.

Weight gain is an important factor to consider in observing chicken performance. KUB chickens have the highest body weight gain compared to Sentul chickens and Arab chickens both at the age of DOC - 1 month, 1 - 2 months and 2 - 3 months, which means livestock genetics can influence body weight growth. This is consistent with the opinion of Daud *et al.* (2017) which states that one of the factors that can influence chicken body weight gain is the genetic factor of each chicken strain.

#### **Morphometric characteristics of local chickens at 3 months**

From the results of this study regarding the body measurements (morphometrics) of KUB chickens, Sentul chickens, and Arab chickens, the average and different test results are obtained based on the measured parameters as in Table 2.

Based on Table 2 the average difference test results showed that the body measurements of KUB chickens were significantly different ( $P < 0.05$ ) with Sentul chickens and Arab chickens, as well as the body measurements of Sentul chickens were significantly different ( $P < 0.05$ ) with Arab chickens. The highest average body measurements are KUB chickens, while the lowest average body measurements are Arab chickens. This means that KUB chickens have a higher meat production capability than Sentul chickens and Arab chickens. This indicates that KUB chickens are more directed to the broiler-type, although according to Suprijatna (2010) local chickens are dual-purpose chickens but can be selected for specific business purposes as the broiler or layer types. Selection towards meat-based on the body weight of chickens is shown by the properties of linear body surface size which are closely correlated with body weight. This difference in body size is thought to be a result of the genetic influence of livestock because the environmental conditions in which the research has been attempted are almost the same, so the real difference in body size parameters is thought to be caused by genetic diversity. Following the opinion of Rajab and Papilaya (2012) variations in chicken, body size can be caused by the influence of different genetic, environmental, and climatic conditions.

## T<sup>2</sup>-Hotelling test

The T<sup>2</sup>-Hotelling test was used to determine the similarities and differences in body measurements between the two groups of livestock. T<sup>2</sup>-Hotelling test results of body size of KUB chickens, Sentul chickens, and Arab chickens can be seen in Table 3.

Based on T<sup>2</sup>-Hotelling statistical test shows that the KUB chickens body measurements are significantly different ( $P < 0.01$ ) compared to Sentul chickens and Arab chickens, Sentul chickens body measurements are significantly different ( $P < 0.01$ ) from Arab chickens. Differences in livestock body size are thought to be caused by genetic differences. This is following the opinion of Hikmawaty *et al.* (2014) which states that livestock body sizes may differ from one another due to the possibility of differences in diversity due to genetic potential, origin location, maintenance, and mating systems applied in the area. Based on the T<sup>2</sup>-Hotelling test it can be concluded that KUB chickens have the largest body measurements compared to Sentul chickens and Arab chickens, while Arab chickens have the smallest body measurements.

## Principal component analysis

The equations determining the size and shape, total diversity, and eigenvalues of KUB chickens, Sentul chickens, and Arab chickens at 3 months based on principal component analysis are presented in Table 4.

Based on the results of the size equation in Table 4, it can be seen that the total diversity of the first main component which is equalized with the size of the KUB, Sentul and Arab chickens respectively are 61.60%, 72.90% and 60.50% with Eigenvalue 11.08, 5.00 and 7.30. The total diversity of the second main components which is equal to the form in KUB chickens, Sentul chickens, and Arab chickens respectively are 6.70%, 13.11%, and 10.89% with Eigenvalues 1.21, 8.95, and 1.31.

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Variable body measurements that affect the size identifier in KUB chickens are TL and Sentul and Arab chickens are CL. This means that the length of the tibia and chest length is a measure of size in KUB chickens, Sentul chickens, and Arab chickens because it has the largest contribution to the size score in the body size equation.

Variable body measurements of KUB chickens, Sentul chickens, and Arab chickens that influence the shape identifiers respectively are BL, TL, and TC. This means that the back length, the length of the tibia, and the circumference of the shank are the hallmarks of the shape of the chicken because it has the largest contribution to the shape equation. This is following the opinion of Candrawati (2007) argues that identification is done by finding the characteristics of each type of local chicken based on the size and shape which is calculated by the statistical method of Principal Component Analysis (PCA). The shape is strongly influenced by genetics, while the size is more influenced by the environment or regional topography. Analysis of the Principal component (PCA) is one way to find out the discrimination between the size and body shape of chickens. Mariandayani *et al.* (2013) added that the analysis of the main components of phenotypic parameters can be used to determine morphometric parameters that indicate the nation's markers and are referred to as the nation's differentiator variables.

### Conclusion

Body weight, weight gain, and body measurements of KUB chickens are higher than Sentul chickens and Arab chickens. The highest weight gain from DOC - 3 months of KUB chickens, Sentul chickens, and Arab chickens were at 1 - 2 months. The size indicator of KUB chickens was tibia length while in Sentul chickens and Arab chickens were chest length. The shape indicator of KUB chickens is back length, Sentul chickens is tibia length, and Arab chicken is the shank circumference.

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4 **References**

- 5 Ashifudin, E. Kurnianto, and Sutopo. 2017. Karakteristik morfometrik ayam kedu jengger merah  
6 dan jengger hitam generasi pertama di satker ayam maron-temanggung. Jurnal Ilmu Ternak  
7 17: 40–46.
- 8 Candrawati, V. Y. 2007. Studi ukuran dan bentuk tubuh ayam kampung, ayam sentul dan ayam  
9 wareng tangerang melalui analisis komponen utama. Skripsi Institut Pertanian Bogor, Bogor.
- 10 Daud, M., Z. Fuadi, and Mulyadi. 2017. Performa dan persentase karkas ayam ras petelur jantan  
11 pada kepadatan kandang yang berbeda. Agripet. 17: 67-74.
- 12 Gaspersz, V. 2006. Teknik Analisis dalam Penelitian Percobaan. Penerbit. Tarsito Bandung.
- 13 Gunawan, E., D. Kaharuddin, dan Kususiya. 2018. Performans keturunan ayam arras dengan  
14 ayam arab (ayam ketarras) umur 2-12 minggu performance. Jurnal Sain Peternakan  
15 Indonesia. Vol. 13 No. 1 Hal. 89–100.
- 16 Habiburahman, R., S. Darwati, and C. Sumantri. 2018. Pola pertumbuhan ayam silangan pelung  
17 sentul kampung ras pedaging (IPB D-1) g4 umur 1-12 minggu. Jurnal Ilmu Produksi dan  
18 Teknologi Hasil Peternakan 6: 81-89.
- 19 Hikmawaty, A. Gunawan, R. R. Noor, and Jakaria. 2014. Identifikasi ukuran tubuh dan bentuk  
20 tubuh sapi bali di beberapa pusat pembibitan melalui pendekatan Analisis Komponen Utama.  
21 Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan 02: 231-237.
- 22 Hidayah, R., I. Ambarsari, and Subiharta. 2019. Kajian sifat nutrisi, fisik dan sensori daging ayam  
23 KUB di Jawa tengah. Jurnal Peternakan Indonesia 21: 93-101.
- 24 Indra, G. K., Achmanu, and A. Nurgartiningih. 2013. Performans produksi ayam Arab (*gallus*  
25 *turcicus*) berdasarkan warna bulu. Jurnal Ternak Tropika 14: 8-14.
- 26 Kurnia, Y. 2011. Morfometrik ayam Sentul, Kampung dan Kedu pada fase pertumbuhan dari umur  
27 1-12 minggu. Skripsi Institut Pertanian Bogor, Bogor.
- 28 Kurnianto, E., S. Sutopo, E. Purbowati, E.T. Setiatin, D. Samsudewa and T. Permatasari. 2013.  
29 Multivariate analysis of morphological traits of local goats in Central Java-Indonesia. Iranian  
30 Journal of Applied Animal Science 3:361- 367
- 31 Mariandayani, H. N., D. D. Solihin, S. Sulandari, and C. Sumantri. 2013. Keragaman fenotipik dan  
32 pendugaan jarak genetik pada ayam lokal dan ayam broiler menggunakan analisis morfologi.  
33 Jurnal Veteriner 14: 475-484.

- 1 ~~Suryana. 2017. Pengembangan ayam Kampung Unggul Balitbangtan (KUB) di Kalimantan~~  
2 ~~Selatan. Wartazoa 27: 45-52.~~
- 3
- 4 Nataamijaya, A. G., A. R. Setioko, B. Brahmantiyo, and K. Diwyanto. 2003. Performans dan  
5 karakteristik tiga galur ayam lokal (Pelung, Arab, dan Sentul). Puslitbang Peternakan, Bogor.  
6 353-359.
- 7 Rajab and B. J. Papilaya. 2012. Sifat kuantitatif ayam kampung lokal pada pemeliharaan  
8 tradisional. Agrinimal 2: 61-64.
- 9 Subekti, K. and F. Arlina. 2011. Karakteristik genetik eksternal ayam kampung di kecamatan  
10 sungai pagu kabupaten solok selatan. Jurnal Ilmiah Ilmu-Ilmu Peternakan 14: 74-86.
- 11 Suprijatna, E. 2010. Strategi pengembangan ayam lokal berbasis sumber daya lokal dan  
12 berwawasan lingkungan. [Prosiding](#) Seminar Nasional Unggas Lokal ke IV. Fakultas  
13 Peternakan Universitas Diponegoro, Semarang.
- 14 Suryana. 2017. Pengembangan ayam Kampung Unggul Balitbangtan (KUB) di Kalimantan  
15 Selatan. Wartazoa 27: 45-52.
- 16 Urfa, S., H. Indijani, and W. Tanwiriah. 2017. Model kurva pertumbuhan ayam kampung unggul  
17 balitnak (KUB) umur 0-12 minggu. Jurnal Ilmu Ternak 17: 59-66.

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Table 1. Average body weight of local chickens

Age	Local Chicken		
	KUB chicken	Sentul chicken	Arab chicken
DOC (g)	34.20±3.09 <sup>a</sup>	33.85 ±2.53 <sup>a</sup>	33.45±3.33 <sup>a</sup>
1 month (g)	235.64±38.63 <sup>a</sup>	217.06±42.88 <sup>b</sup>	210.50±35.28 <sup>b</sup>
2 months (g)	713.15±66.75 <sup>a</sup>	632.88±85.10 <sup>b</sup>	591.20±55.11 <sup>c</sup>
3 months (g)	1108.42±84.52 <sup>a</sup>	1021.44±100.42 <sup>b</sup>	874.57±74.21 <sup>c</sup>

Note: Different letter superscripts on the same line for each type of chicken mean significantly different (P <0.05)

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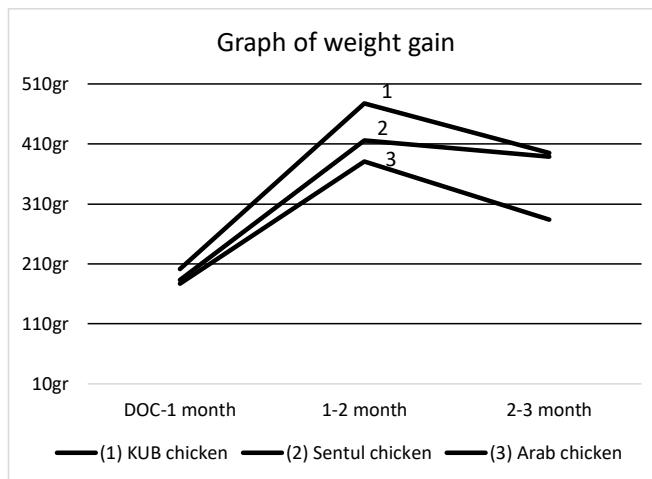


Figure 1. Graph of weight gain of local chicken bodies

Table 2. Morphometric characteristics of local chickens at 3 months

Body Measurements	KUB chicken	Sentul chicken	Arab chicken
BL (mm)	34.76±1.61 <sup>a</sup>	32.32±1.51 <sup>b</sup>	30.07±1.63 <sup>c</sup>
BW (mm)	7.84±0.50 <sup>a</sup>	7.08±0.69 <sup>b</sup>	6.37±0.54 <sup>c</sup>
HL (mm)	40.27±1.86 <sup>a</sup>	36.37±1.11 <sup>b</sup>	34.18±1.67 <sup>c</sup>
HC (mm)	32.30±2.10 <sup>a</sup>	30.25±1.66 <sup>b</sup>	28.52±1.56 <sup>c</sup>
HH (mm)	109.68±4.21 <sup>a</sup>	103.22±5.23 <sup>b</sup>	99.97±4.23 <sup>c</sup>
NL (mm)	125.83±5.24 <sup>a</sup>	117.27±6.69 <sup>b</sup>	96.78±5.80 <sup>c</sup>
NC (mm)	83.32±5.84 <sup>a</sup>	78.36±5.26 <sup>b</sup>	72.56±4.03 <sup>c</sup>
WL (mm)	190.07±6.42 <sup>a</sup>	180.02±7.40 <sup>b</sup>	172.69±6.47 <sup>c</sup>
BL (mm)	208.17±7.63 <sup>a</sup>	190.78±6.89 <sup>b</sup>	179.52±5.12 <sup>c</sup>
BH (mm)	265.76±8.50 <sup>a</sup>	241.50±8.58 <sup>b</sup>	227.42±5.75 <sup>c</sup>

CL (mm)	121.21±6.16 <sup>a</sup>	113.29±6.84 <sup>b</sup>	105.42±4.84 <sup>c</sup>
CW (mm)	56.39±4.31 <sup>a</sup>	52.30±3.13 <sup>b</sup>	48.58±4.50 <sup>c</sup>
SL (mm)	79.25±6.75 <sup>a</sup>	72.87±5.87 <sup>b</sup>	67.32±4.17 <sup>c</sup>
SC (mm)	42.07±2.29 <sup>a</sup>	38.39±2.52 <sup>b</sup>	35.17±1.84 <sup>c</sup>
TL (mm)	118.58±6.96 <sup>a</sup>	111.12±4.83 <sup>b</sup>	106.47±5.49 <sup>c</sup>
TC (mm)	95.71±7.07 <sup>a</sup>	90.15±5.49 <sup>b</sup>	84.42±5.25 <sup>c</sup>
TFL (mm)	62.88±5.43 <sup>a</sup>	55.67±4.77 <sup>b</sup>	51.49±3.45 <sup>c</sup>
PBD (mm)	14.74±0.58 <sup>a</sup>	14.99±0.91 <sup>b</sup>	15.44±0.91 <sup>c</sup>

Note: Different letter superscripts on the same line for each type of chicken mean significantly different (P < 0.05), BL = Beak Length, BW = Beak Width (BW), HL = Head Length, HC = Head Circumference, HH = Head Height, NL = Neck Length, NC = Neck Circumference, WL = Wing Length, BL = Back Length, BH = Back Height, CL = Chest Length, CW = Chest Width, SL = Shank Length, SC = Shank Circumference, TL = Tibia Length, TC = Tibia Circle, TFL = Third Finger Length and PBD = Pubic Bone Distance.

Table 3. T2-Hotelling Test for local chicken body measurements

Body Measurements	Statistics T <sup>2</sup> Hotelling	F Value	P Value	Conclusion
KUB-S	375.9094	16.9681	0.00	**
KUB-A	1530.389	69.0800	0.00	**
S-A	826.1915	37.2934	0.00	**

Note: KUB = Kampung Unggul Balitnak chicken, S = Sentul chicken, A = Arab chicken. \*\* = Significantly Different (P < 0.01).

Table 4. Equation determining determinant of body size and shape with total diversity and eigenvalue in chickens

Type		Equation	KT (%)	λ
KUB chicken	Body Size	0.256 BL + 0.239 BW + 0.206 HL + 0.177 HC + 0.245 HH + 0.244 NL + 0.243 NC + 0.241 WL + 0.176 BL + 0.174 BH + 0.250 CL + 0.259 CW + 0.262 SL + 0.223 SC + <b>0.263 TL</b> + 0.243 TC + 0.257 TFL + 0.253 PBD	61.60%	11.08
	Body Shape	0.132 BL + 0.301 BW - 0.118 HL - 0.426 HC - 0.149 HH - 0.350 NL - 0.287 NC - 0.113 WL + <b>0.379 BL</b> + 0.245 BH + 0.268 CL + 0.077 CW + 0.215 SL - 0.206 SC + 0.185 TL - 0.216 TC + 0.066 TFL - 0.030 PBD	6.70%	1.21
Sentul chicken	Body Size	0.243 BL + 0.200 BW + 0.187 HL + 0.234 HC + 0.250 HH + 0.243 NL + 0.246 NC + 0.216 WL + 0.230 BL + 0.227 BH + <b>0.262 CL</b> + 0.248 CW + 0.261 SL + 0.236 SC + 0.225 TL + 0.252 TC + 0.257 TFL + 0.208 PBD	72.90%	5.00
	Body Shape	-0.111 BL - 0.453 BW - 0.646 HL + 0.023 HC + 0.124 HH + 0.085 NL - 0.031 NC + 0.289 WL + 0.027 BL - 0.059 BH + 0.177 CL + 0.002 CW + 0.029 SL - 0.052 SC + <b>0.389 TL</b> + 0.073 TC - 0.187 TFL + 0.164 PBD	13.11%	8.95
Arab chicken	Body Size	0.254 BL + 0.250 BW + 0.245 HL + 0.254 HC + 0.250 HH + 0.201 NL + 0.234 NC + 0.209 WL + 0.258 BL + 0.250 BH + <b>0.263 CL</b> + 0.258 CW + 0.258 SL + 0.239 SC + 0.221 TL + 0.203 TC + 0.194 TFL + 0.176 PBD	60.50%	7.30
	Body Shape	-0.271 BL - 0.255 BW - 0.053 HL - 0.067 HC - 0.063 HH - 0.014 NL - 0.106 NC - 0.100 WL + 0.046 BL -	10.89%	1.31



$$0.315 \text{ BH} - 0.067 \text{ CL} - 0.002 \text{ CW} + 0.001 \text{ SL} - 0.093 \\ \text{SC} + 0.384 \text{ TL} + \mathbf{0.461 \text{ TC}} + 0.417 \text{ TFL} + 0.424 \text{ PBD}$$

1 Note: Different letter superscripts on the same line for each type of chicken mean significantly different (P  
2 <0.05), BL = Beak Length, BW = Beak Width (BW), HL = Head Length, HC = Head Circumference, HH =  
3 Head Height, NL = Neck Length, NC = Neck Circumference, WL = Wing Length, BL = Back Length, BH =  
4 Back Height, CL = Chest Length, CW = Chest Width, SL = Shank Length, SC = Shank Circumference, TL  
5 = Tibia Length, TC = Tibia Circle, TFL = Third Finger Length and PBD = Pubic Bone Distance.

6

# Growth Patterns, Body Weight, and Morphometric of KUB Chicken, Sentul Chicken and Arab Chicken

## Pola Pertumbuhan Bobot Badan dan Morfometrik Ayam KUB, Ayam Sentul dan Ayam Arab

### ABSTRACT

The purpose of this research was to determine the body weight, weight gain and morphometric characteristics of several local chicken strains. The research materials were KUB chicken, Sentul chicken, and Arab chicken. The method used was an experiment with a sample of 82 chickens from each strain. Data collected include body weight, weight gain, beak length, beak width, head length, head circumference, head height, neck length, neck circumference, wing length, back length, back height, chest length, chest width, shank length, shank circumference, tibia length, tibia circumference, third finger length, and pubic bone distance. Data collected were analyzed using the average difference test (t-test). The average value vector of body measurements of chicken lines was analyzed using the *T<sup>2</sup>-Hotelling* (atau *Hotteling diseragamkan*) statistical test. Main Component Analysis statistical test was used to identify the shape and size characteristics of each chicken strain. The results showed that the body weight and morphometrics of KUB chickens at 3 months were significantly different ( $P < 0.05$ ) with Sentul chickens and Arab chickens. KUB chicken's body weight gain at 3 months was not significantly different ( $P > 0.05$ ) from Sentul chickens, but it was significantly different ( $P < 0.05$ ) from Arab chickens. Body weight, weight gain, and morphometrics of KUB chickens were higher/better than Sentul chickens and Arab chickens. The size indicator in KUB chickens was the tibia length while in Sentul chickens and Arab chickens was chest length. The characteristic of KUB chickens was the back length, Sentul chickens was tibia length, and Arab chickens was the shank circumference.

**Keywords:** Body weight, *Increased body Weight gain*, Body measures, KUB chicken, Sentul chicken, Arab chicken

### INTISARI

Tujuan penelitian ini untuk mengetahui bobot badan dan karakteristik morfometrik beberapa galur ayam lokal. Materi penelitian ini adalah ayam KUB, ayam Sentul, dan ayam Arab. Metode yang digunakan adalah eksperimen dengan jumlah sampel 82 ekor ayam dari masing-masing galur. Data yang dihimpun meliputi: bobot badan, pertambahan bobot badan, panjang paruh, lebar paruh, panjang kepala, lingkaran kepala, tinggi kepala, panjang leher, lingkaran

1 leher, panjang sayap, panjang punggung, tinggi punggung, panjang dada, lebar dada, panjang  
2 *shank*, lingkaran shank, panjang tibia, lingkaran tibia, panjang jari terpanjang dan jarak tulang pubis.  
3 Data yang telah dikumpulkan dianalisis menggunakan uji beda rata-rata (uji-t). Vektor nilai rata-  
4 rata ukuran-ukuran tubuh galur ayam dianalisis menggunakan uji statistik  $T^2$ -Hotelling. Uji  
5 statistik Analisis Komponen Utama untuk mengidentifikasi penciri bentuk dan ukuran tubuh pada  
6 masing-masing galur ayam. Hasil penelitian menunjukkan bahwa bobot badan dan morfometrik  
7 ayam KUB pada umur 3 bulan berbeda nyata ( $P < 0,05$ ) dengan ayam Sentul maupun ayam  
8 Arab. Pertambahan bobot badan ayam KUB pada umur 3 bulan berbeda tidak nyata ( $P > 0,05$ )  
9 dengan ayam Sentul, namun berbeda nyata ( $P < 0,05$ ) dengan ayam Arab. Bobot badan,  
10 pertambahan bobot badan, dan morfometrik ayam KUB lebih tinggi baik dibandingkan ayam  
11 Sentul dan ayam Arab. Penciri ukuran pada ayam KUB adalah panjang tibia sedangkan pada  
12 ayam Sentul dan ayam Arab adalah panjang dada. Penciri bentuk ayam KUB adalah panjang  
13 punggung, pada ayam Sentul adalah panjang tibia, dan pada ayam Arab adalah lingkaran shank.

14 Kata kunci: Bobot badan, Pertambahan bobot badan, Ukuran-ukuran tubuh, Ayam KUB, Ayam  
15 Sentul, Ayam Arab

## Introduction

Indonesia is one of the countries with the most population, so the availability of both plant and animal food is very much needed. One of the livestock that can be used as a source of animal protein is chicken. Chicken is one of the livestock that is often raised by the people of Indonesia and provides a large enough role in meeting the needs of the animal protein community. Indonesia has dozens of strains of chicken that have the potential to be developed, one of which is local chicken. Local chickens are very well known by the people of Indonesia because of their very wide distribution area. Among the many local chickens in Indonesia, several strains that are tried to be developed are Sentul chickens, KUB chickens (Kampung Unggul Balitnak), and Arab chickens.

KUB chicken is the Superior Kampung chicken of the Indonesian Agency for Agricultural Research and Development which is the result of selection from a native chicken family for 6 generations (Hidayah *et al.*, 2019). KUB chickens are raised to produce eggs and meat production. KUB chickens have promising prospects both economically and socially because it can supply the needs of highly nutritious food and have the absorption capacity of local and regional markets (Suryana, 2017).

Sentul chicken is one type of local chicken in Indonesia that has been recognized as germplasm of Ciamis Regency through Minister of Agriculture Decree No. 689/Kpts.PD41/2/2013 concerning the Determination of Sentul Chickens Clumps as Indonesian Local Clumps from Ciamis (Menteri Pertanian, 2013). Sentul chicken has the potential to be developed as meat and egg-producing chicken because it has good performance in terms of productivity.

Arab chickens originating from Belgium are also called *Kriel Braekels* which are included in the superior laying hens in Belgium. Arabic chicken is one of the native chickens that have been adapted in Indonesia (Gunawan *et al.*, 2018). Arab chickens initially received less attention from breeders, but now Arab chickens have begun to be developed and increased in production.

1 Arab chicken is one type of egg-producing chicken that is quite potential because of its high egg  
2 production resembling the productivity of laying hens. Arabian chickens are superior laying hens  
3 classified as light type chickens with a body weight of 40 weeks reaching 2.035g (Indra *et al.*,  
4 2013).

5 Information about KUB chickens, Sentul chickens, and Arab chickens are not widely  
6 known, especially regarding their genetic potential. Genetic information is needed to determine  
7 the genetic quality of livestock which will be used as a material consideration in the selection  
8 and crossbreeding of local chickens in the future. Efforts can be made to obtain basic  
9 information about the genetic quality of livestock, it is necessary to do morphometric  
10 characterization of KUB chickens, Sentul chickens, and Arab chickens.

11 Morphometrics is a quantitative data collection activity that can be used to determine the  
12 level of livestock productivity, identification, and determinants of the characteristics of livestock  
13 which includes size and shape. Morphometric characteristics can be described by femur length,  
14 tibia length, maxilla length, wing length, tarsometatarsus length, tarsometatarsus circumference,  
15 third finger length (middle), and sternum length (Ashifudin *et al.*, 2017). Each type of chicken has  
16 unique characteristics both in size and body shape. Body measurements can be used to study  
17 animal growth and development. Morphometric measurements can also help the process of  
18 selection and crossbreeding between nations and types (Kurnianto *et al.*, 2013). The importance  
19 of this research is due to the lack of knowledge about morphometrics, especially in KUB  
20 chickens, Sentul chickens, and Arab chickens which can later be used as basic information for  
21 the development of local chickens in the future.

## 23 **Materials and Methods**

24 The research material is KUB chickens, Sentul chickens, and Arab chickens that are kept  
25 from the age of DOC until the age of 3 months. [The number of samples was 82 heads \(41 males](#)

and 41 females) from each chicken strain. The equipment used is a digital caliper, digital scales capacity of 3 kg with an accuracy of 0.01 grams, measuring tape, digital cameras, stationery, 1 unit cage, place of feed and drink, commercial feed and drinking water, vaccines, and 4 medicines.

The method used in this study was an experiment on body measurements and body weight of 5 KUB chickens, Sentul chickens and Arabic chickens. ~~The number of samples was 82 heads (41 males~~ 6 ~~and 41 females) tails from each chicken strain that was kept from the age of DOC until the age of 3~~ 7 ~~months.~~ The Chicken breeding system in a colony cage where each strain is placed in a different cage 8 with other strains. The size of the cage used is 4 x 3 x 1.8 cm which is equipped with a place to feed, 9 drink, and lighting. Feeding and drinking are done continuously (*ad libitum*). Measurement of body 10 measurements and body weight is done every month and every chicken that is measured is marked 11 on the wings. Data collected includes body weight (BW), weight gain (WG), and morphometrics of 12 chickens. Variables measured include beak length (BL), beak width (BW), head length (HL), head 13 circumference (HC), head height (HH), neck length (NL), neck circumference (NC), wing length (WL), 14 back length (BL), back height (BH), chest length (CL), chest width (CW), shank length (SL), shank 15 circumference (SC), tibia length (TL), tibia ~~circumference~~ (TC), third finger length (TFL) and pubic 16 bone distance (PBD) based according to Koch (1973) : Sisson dan Grossman. (1975). 17

18 1. Body Weight (BB) was measured by weighing chickens with digital scales (g).

19 2. Beak Length (BL) between the base of the maxilla to the tip of the maxilla, as measured by a  
20 digital calipers (mm).

21 3. Beak Width (BW) was measured from the outer half of the left and right, using a digital calipers  
22 (mm).

23 4. Head Length (HL) was measured from the base of the beak to the rear of the head, using a  
24 digital calipers (mm).

25 5. Head Circumference (HC) was measured at the highest part of the head by using a measuring  
26 tape (cm converted to mm).

- 1 6. Head Height (HH) was measured at the highest part of the head using a digital calipers (mm).
- 2 7. Neck Length (NL) was measured from the first cervical vetebrae to the last cervical vetebrae
- 3 using a digital caliper (cm).
- 4 8. Neck Circumference (NC) wraps around the measuring tape around the neck (cm converted to
- 5 mm).
- 6 9. Wing Length (WL) was measured from the humeral bone to the tip of the phalanges using a
- 7 measuring tape (cm converted to mm).
- 8 10. Back Length (BL) was measured from the tip of the neck to the base of the tail using a
- 9 measuring tape (cm converted to mm).
- 10 11. Back Height (BH) was measured from the bottom of the rests to the back using a ruler (cm
- 11 converted to mm).
- 12 12. Chest Length (CL) measurement of the length of the chest (sternum) was carried out from the
- 13 front of the chest to the back of the chest using a digital caliper (mm).
- 14 13. Chest Width (CW) measurement of chest width was obtained by measuring the distance from
- 15 the left to the right (widest) sternal bone using a digital calipers (mm).
- 16 14. Shank Length (SL) was measured along the tarsometatarsus bone (shank) using a digital
- 17 caliper (mm).
- 18 15. Circumference Shank (CS) around the measuring tape at the center of the tarsometatarsus
- 19 bone (shank) (cm converted to mm).
- 20 16. Tibia Length (TL) was measured from the patella to the tip of the tibia using a digital calipers
- 21 (mm)
- 22 17. Tibia Circumference (TC) wraps measuring tape around the tibia (cm converted to mm)
- 23 18. Third Finger Length (TFL) was measured from the base to the tip of the third finger using a
- 24 digital calipers (mm).
- 25 19. Pubic Bone Distance (JTP) is measured using digital calipers (mm).

1 Data that has been collected include body weight and body measurements grouped by  
2 sex, then corrected to male measurements. After that continued with~~then~~ analyzed using the  
3 average difference test (t-test). The average value vector of the two sex groups includes BL,  
4 BW, HL, HC, HH, NL, NC, WL, BL, BH, CL, CW, SL, SC, TL, TC, TFL, PBD were analyzed  
5 using the  $T^2$ -Hotelling statistical test. Then do the statistical test to identify determinants of body  
6 shape and size in chickens using Principal Component Analysis (PCA) (Gaspersz, 2006). Data  
7 processing is assisted by using Minitab statistical software version 18.

8



## Results and Discussion

### Local chicken body weight DOC-3 months

The average body weight of KUB chickens, Sentul chickens, and Arab chickens aged DOC up to 3 months are presented in Table 1.

Based on Table 1 it can be seen that the average body weight of 3 months in KUB chickens is  $1108.42 \pm 84.52$  g, in Sentul chickens is  $1021.44 \pm 100.42$  g, while in Arab chickens is  $874.57 \pm 74.21$  g. The average body weight of KUB chickens in this study is higher than the results of Suryana (2017) research which states the average body weight of KUB chickens at 3 months is 750 g. The average body weight of Sentul chickens in this study was higher than Kurnias (2011) research which was 532.1 g. However, the average body weight of Sentul chickens in this study is lower than Habiburahman *et al.* (2018) research in Pelung Sentul crossbreed chickens at 3 months of age is 1193.9 gr. The average body weight of Arab chickens in this study is higher than Nataamijaya *et al.* (2003) research with an average of 700 gr. This difference in results is thought to be due to genetic, environmental, and maintenance management differences. This is in accordance with the statement of Subekti and Arlina (2011) which states that differences in body size of chickens can be caused by different environmental conditions of the origin of the seeds and different maintenance environments, as well as genetic factors.

The results of the average difference test (t-test) showed that the DOC KUB chickens weight was not significantly different ( $P>0.05$ ) with Sentul chickens or Arab chickens, as well as Sentul chickens not significantly different ( $P>0.05$ ) with Arab chickens. Body weight at 1 month of age KUB chickens was significantly different ( $P<0.05$ ) with Sentul chickens and Arab chickens, while Sentul chickens body weight was not significantly different ( $P>0.05$ ) from Arab chickens. This is due to variations in the rate of growth between individuals in the form of slow growth at the beginning of the week which then increases at the end of maintenance. At 2

months KUB chickens were significantly different ( $P<0.05$ ) from Sentul chickens and Arab chickens, as well as Sentul chickens body weight significantly different ( $P<0.05$ ) from Arab chickens. Body weight at 3 months showed that KUB chickens were significantly different ( $P<0.05$ ) from Sentul chickens and Arab chickens, as well as Sentul chickens significantly different ( $P<0.05$ ) from Arab chickens. Based on Table 1 it can be seen that the highest body weight at DOC age, 1 month, 2 months and 3 months is KUB chickens, while the lowest body weight is Arab chickens, it can be stated that KUB chicken has a higher body weight than Sentul chickens and Arab chickens. The differences in body weight are due to differences in genetics, seedling origin, and environmental adaptation. According to Zainal *et al.* (2012) the difference in body weight in livestock shows that each breed has a different ability in growth. This occurs due to differences in the ability to adapt to the environment which is an indication of the magnitude of environmental influence on the ability to grow.

#### **Weight gain of local chicken**

The weight gain of KUB chickens, Sentul chickens, and Arab chickens at the age of DOC – 3 months are presented in Figure 1.

Based on the different tests the average body weight gain of DOC KUB chickens was not significantly different ( $P>0.05$ ) with Sentul chickens and with Arab chickens. The weight gain of 1 - 2 months KUB chickens were significantly different ( $P<0.05$ ) with Sentul chickens and Arab chickens, as well as Sentul chickens body weight gain was significantly different ( $P<0.05$ ) with Arab chicken. Body weight gain of 2 - 3 months KUB chickens were not significantly different ( $P>0.05$ ) with Sentul chickens but significantly different ( $P<0.05$ ) from Arab chickens, while Sentul chickens body weight gain was significantly different ( $P<0.05$ ) with Arab chickens.

Figure 1 shows that the average weight gain of KUB chickens, Sentul chickens, and Arab chickens from DOC - 3 months of age in a row are KUB chickens was  $201.44 \pm 37.92$  g,  $477.51 \pm 56.75$  g, and  $395.27 \pm 103.09$  g. The average weight gain of Sentul chickens was  $183.21 \pm$

42.91 g,  $415.82 \pm 95.84$  g, and  $388.57 \pm 100.39$  g. While the average body weight gain of Arab chickens was  $177.04 \pm 36.55$  g,  $380.70 \pm 53.15$  g, and  $283.37 \pm 80.58$  g. The weight gain of KUB chickens, Sentul chickens, and Arab chickens continue to increase or grow rapidly at the age of 1 - 2 months and decrease at the age of 2 - 3 months. This is in line with the opinion of Urfa *et al.* (2017) which states the growth of chicken body weight will be fast and reach a specific weight at a young age.

Weight gain is an important factor to consider in observing chicken performance. KUB chickens have the highest body weight gain compared to Sentul chickens and Arab chickens both at the age of DOC - 1 month, 1 - 2 months and 2 - 3 months, which means livestock genetics can influence body weight growth. [Kub chickens is a cross chicken from the selection of female Kampung chickens in West Java to increase livestock productivity through crossing between lines to get a high level of heterosis.](#) This is consistent with the opinion of Daud *et al.* (2017) which states that one of the factors that can influence chicken body weight gain is the genetic factor of each chicken strain.

### **Morphometric characteristics of local chickens at 3 months**

From the results of this study regarding the body measurements (morphometrics) of KUB chickens, Sentul chickens, and Arab chickens, the average and different test results are obtained based on the measured parameters as in Table 2.

Based on Table 2 the average difference test results showed that the body measurements of KUB chickens were significantly different ( $P < 0.05$ ) with Sentul chickens and Arab chickens, as well as the body measurements of Sentul chickens were significantly different ( $P < 0.05$ ) with Arab chickens. The highest average body measurements are KUB chickens, while the lowest average body measurements are Arab chickens. This means that KUB chickens have a higher meat production capability than Sentul chickens and Arab chickens. This indicates that KUB chickens are more directed to the broiler-type, although according to Suprijatna (2010) local

chickens are dual-purpose chickens but can be selected for specific business purposes as the broiler or layer types. Selection towards meat-based on the body weight of chickens is shown by the properties of linear body surface size which are closely correlated with body weight. This difference in body size is thought to be a result of the genetic influence of livestock because the environmental conditions in which the research has been attempted are almost the same, so the real difference in body size parameters is thought to be caused by genetic diversity. Following the opinion of Rajab and Papilaya (2012) variations in chicken, body size can be caused by the influence of different genetic, environmental, and climatic conditions.

### ***T<sup>2</sup>-Hotelling* test**

The T<sup>2</sup>-Hotelling test was used to determine the similarities and differences in body measurements between the two groups of livestock. *T<sup>2</sup>-Hotelling* test results of body size of KUB chickens, Sentul chickens, and Arab chickens can be seen in Table 3.

Based on *T<sup>2</sup>-Hotelling* statistical test shows that the KUB chickens body measurements are significantly different ( $P < 0.01$ ) compared to Sentul chickens and Arab chickens, Sentul chickens body measurements are significantly different ( $P < 0.01$ ) from Arab chickens. Differences in livestock body size are thought to be caused by genetic differences. This is following the opinion of Hikmawaty *et al.* (2014) which states that livestock body sizes may differ from one another due to the possibility of differences in diversity due to genetic potential, origin location, maintenance, and mating systems applied in the area. Based on the T<sup>2</sup>-Hotelling test it can be concluded that KUB chickens have the largest body measurements compared to Sentul chickens and Arab chickens, while Arab chickens have the smallest body measurements.

### **Principal component analysis**

1 The equations determining the size and shape, total diversity, and eigenvalues of KUB  
2 chickens, Sentul chickens, and Arab chickens at 3 months based on principal component  
3 analysis are presented in Table 4.

4 Based on the results of the size equation in Table 4, it can be seen that the total diversity  
5 of the first main component which is equalized with the size of the KUB, Sentul and Arab  
6 chickens respectively are 61.60%, 72.90% and 60.50% with Eigenvalue 11.08, 5.00 and 7.30.  
7 The total diversity of the second main components which is equal to the form in KUB chickens,  
8 Sentul chickens, and Arab chickens respectively are 6.70%, 13.11%, and 10.89% with  
9 Eigenvalues 1.21, 8.95, and 1.31.

10 Variable body measurements that affect the size identifier in KUB chickens are TL  
11 ~~butand~~ Sentul and Arab chickens are CL. This means that the length of the tibia and chest  
12 length is a measure of size in KUB chickens, Sentul chickens, and Arab chickens because it has  
13 the largest contribution to the size score in the body size equation.

14 Variable body measurements of KUB chickens, Sentul chickens, and Arab chickens that  
15 influence the shape identifiers respectively are BL, TL, and TC. This means that the back length,  
16 the length of the tibia, and the circumference of the shank are the hallmarks of the shape of the  
17 chicken because it has the largest contribution to the shape equation. This is following the  
18 opinion of Candrawati (2007) argues that identification is done by finding the characteristics of  
19 each type of local chicken based on the size and shape which is calculated by the statistical  
20 method of Principal Component Analysis (PCA). The shape is strongly influenced by genetics,  
21 while the size is more influenced by the environment or regional topography. Analysis of the  
22 Principal component (PCA) is one way to find out the discrimination between the size and body  
23 shape of chickens. Mariandayani *et al.* (2013) added that the analysis of the main components  
24 of phenotypic parameters can be used to determine morphometric parameters that indicate the  
25 nation's markers and are referred to as the nation's differentiator variables.

## Conclusion

Body weight, weight gain, and body measurements of KUB chickens are higher than Sentul chickens and Arab chickens. The highest weight gain from DOC - 3 months of KUB chickens, Sentul chickens, and Arab chickens were at 1 - 2 months. The size indicator of KUB chickens was tibia length while in Sentul chickens and Arab chickens were chest length. The shape indicator of KUB chickens is back length, Sentul chickens is tibia length, and Arab chicken is the shank circumference.

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## References

- Ashifudin, E. Kurnianto, and Sutopo. 2017. Karakteristik morfometrik ayam kedu jengger merah dan jengger hitam generasi pertama di satker ayam maron-temanggung. *Jurnal Ilmu Ternak* 17: 40–46.
- Candrawati, V. Y. 2007. Studi ukuran dan bentuk tubuh ayam kampung, ayam sentul dan ayam wareng tangerang melalui analisis komponen utama. Skripsi Institut Pertanian Bogor, Bogor.
- Daud, M., Z. Fuadi, and Mulyadi. 2017. Performa dan persentase karkas ayam ras petelur jantan pada kepadatan kandang yang berbeda. *Agripet*. 17: 67-74.
- Gaspersz, V. 2006. Teknik Analisis dalam Penelitian Percobaan. Penerbit. Tarsito Bandung.
- Gunawan, E., D. Kaharuddin, dan Kususiyah. 2018. Performans keturunan ayam arras dengan ayam arab (ayam ketarras) umur 2-12 minggu performance. *Jurnal Sain Peternakan Indonesia*. Vol. 13 No. 1 Hal. 89–100.
- Habiburahman, R., S. Darwati, and C. Sumantri. 2018. Pola pertumbuhan ayam silangan pelung sentul kampung ras pedaging (IPB D-1) g4 umur 1-12 minggu. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 6: 81-89.
- Hikmawaty, A. Gunawan, R. R. Noor, and Jakaria. 2014. Identifikasi ukuran tubuh dan bentuk tubuh sapi bali di beberapa pusat pembibitan melalui pendekatan Analisis Komponen Utama. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 02: 231-237.

1 Hidayah, R., I. Ambarsari, and Subiharta. 2019. Kajian sifat nutrisi, fisik dan sensori daging  
2 ayam KUB di Jawa Tengah. Jurnal Peternakan Indonesia 21: 93-101.

3 Indra, G. K., Achmanu, and A. Nurgiartiningsih. 2013. Performans produksi ayam Arab (*gallus*  
4 *turcicus*) berdasarkan warna bulu. Jurnal Ternak Tropika 14: 8-14.

5 [Koch, T. 1973. Anatomy of the Chicken and Domestic Bird. The Iowa State University Press,](#)  
6 [Iowa.](#)

7 Kurnia, Y. 2011. Morfometrik ayam Sentul, Kampung dan Kedu pada fase pertumbuhan dari  
8 umur 1-12 minggu. Skripsi Institut Pertanian Bogor, Bogor.

9 Kurnianto, E., S. Sutopo, E. Purbowati, E.T. Setiatin, D. Samsudewa and T. Permatasari. 2013.  
10 Multivariate analysis of morphological traits of local goats in Central Java-Indonesia.  
11 Iranian Journal of Applied Animal Science 3:361- 367

12 Mariandayani, H. N., D. D. Solihin, S. Sulandari, and C. Sumantri. 2013. Keragaman fenotipik  
13 dan pendugaan jarak genetik pada ayam lokal dan ayam broiler menggunakan analisis  
14 morfologi. Jurnal Veteriner 14: 475-484.

15 ~~Suryana. 2017. Pengembangan ayam Kampung Unggul Balitbangtan (KUB) di Kalimantan~~  
16 ~~Selatan. Wartazoa 27: 45-52.~~

17  
18 Nataamijaya, A. G., A. R. Setioko, B. Brahmantiyo, and K. Diwyanto. 2003. Performans dan  
19 karakteristik tiga galur ayam lokal (Pelung, Arab, dan Sentul). Puslitbang Peternakan,  
20 Bogor. 353-359.

21 Rajab and B. J. Papilaya. 2012. Sifat kuantitatif ayam kampung lokal pada pemeliharaan  
22 tradisional. Agrinimal 2: 61-64.

23 [Sisson dan Grossman. 1975. The Anatomy of the Domestic Animals. 5th ed. W. B. Saunders.](#)  
24 [Co Philadelphia.](#)

25 Subekti, K. and F. Arlina. 2011. Karakteristik genetik eksternal ayam kampung di kecamatan  
26 sungai pagu kabupaten solok selatan. Jurnal Ilmiah Ilmu-Ilmu Peternakan 14: 74-86.

27 Suprijatna, E. 2010. Strategi pengembangan ayam lokal berbasis sumber daya lokal dan  
28 berwawasan lingkungan. [Prosiding](#) Seminar Nasional Unggas Lokal ke IV. Fakultas  
29 Peternakan Universitas Diponegoro, Semarang.

30 ~~Suryana. 2017. Pengembangan ayam Kampung Unggul Balitbangtan (KUB) di Kalimantan~~  
31 ~~Selatan. Wartazoa 27: 45-52.~~

32 Urfa, S., H. Indijani, and W. Tanwiriah. 2017. Model kurva pertumbuhan ayam kampung unggul  
33 balitnak (KUB) umur 0-12 minggu. Jurnal Ilmu Ternak 17: 59–66.

34 ~~Zainal, H., T. Sartika, D. Zainuddin, and Komarudin. 2012. Persilangan pada ayam lokal (kub,~~

sentul, gaok) untuk meningkatkan produksi daging unggas nasional. Workshop Nasional Unggas Lokal. 102-108.

Table 1. Average body weight of local chickens

Age	Local Chicken		
	KUB chicken	Sentul chicken	Arab chicken
DOC (g)	34.20±3.09 <sup>a</sup>	33.85 ±2.53 <sup>a</sup>	33.45±3.33 <sup>a</sup>
1 month (g)	235.64±38.63 <sup>a</sup>	217.06±42.88 <sup>b</sup>	210.50±35.28 <sup>b</sup>
2 months (g)	713.15±66.75 <sup>a</sup>	632.88±85.10 <sup>b</sup>	591.20±55.11 <sup>c</sup>
3 months (g)	1108.42±84.52 <sup>a</sup>	1021.44±100.42 <sup>b</sup>	874.57±74.21 <sup>c</sup>

Note: Different letter superscripts on the same line for each type of chicken mean significantly different (P <0.05)



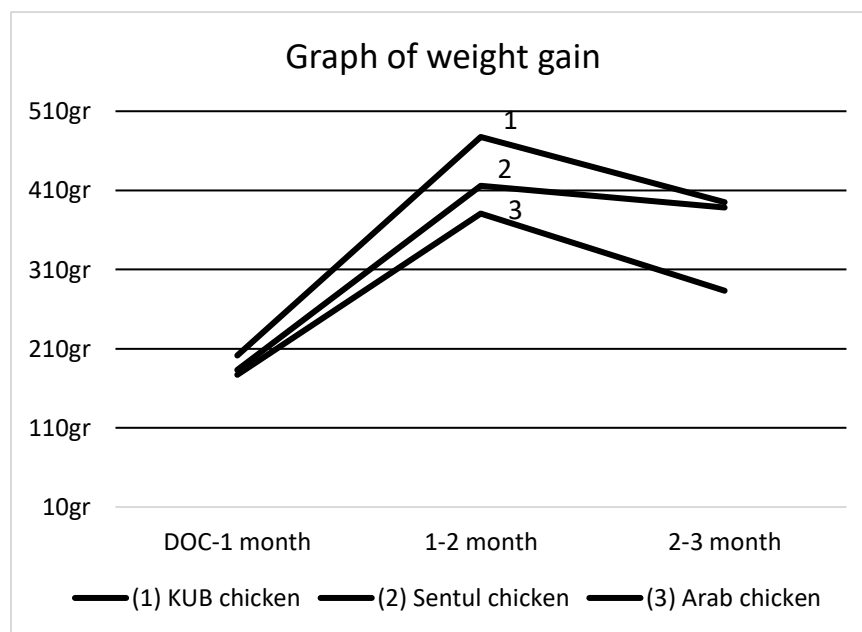


Figure 1. Graph of weight gain of local chicken bodies

Table 2. Morphometric characteristics of local chickens at 3 months

Body Measurements	KUB chicken	Sentul chicken	Arab chicken
BL (mm)	34.76±1.61 <sup>a</sup>	32.32±1.51 <sup>b</sup>	30.07±1.63 <sup>c</sup>
BW (mm)	7.84±0.50 <sup>a</sup>	7.08±0.69 <sup>b</sup>	6.37±0.54 <sup>c</sup>
HL (mm)	40.27±1.86 <sup>a</sup>	36.37±1.11 <sup>b</sup>	34.18±1.67 <sup>c</sup>
HC (mm)	32.30±2.10 <sup>a</sup>	30.25±1.66 <sup>b</sup>	28.52±1.56 <sup>c</sup>
HH (mm)	109.68±4.21 <sup>a</sup>	103.22±5.23 <sup>b</sup>	99.97±4.23 <sup>c</sup>
NL (mm)	125.83±5.24 <sup>a</sup>	117.27±6.69 <sup>b</sup>	96.78±5.80 <sup>c</sup>
NC (mm)	83.32±5.84 <sup>a</sup>	78.36±5.26 <sup>b</sup>	72.56±4.03 <sup>c</sup>
WL (mm)	190.07±6.42 <sup>a</sup>	180.02±7.40 <sup>b</sup>	172.69±6.47 <sup>c</sup>
BL (mm)	208.17±7.63 <sup>a</sup>	190.78±6.89 <sup>b</sup>	179.52±5.12 <sup>c</sup>
BH (mm)	265.76±8.50 <sup>a</sup>	241.50±8.58 <sup>b</sup>	227.42±5.75 <sup>c</sup>
CL (mm)	121.21±6.16 <sup>a</sup>	113.29±6.84 <sup>b</sup>	105.42±4.84 <sup>c</sup>
CW (mm)	56.39±4.31 <sup>a</sup>	52.30±3.13 <sup>b</sup>	48.58±4.50 <sup>c</sup>
SL (mm)	79.25±6.75 <sup>a</sup>	72.87±5.87 <sup>b</sup>	67.32±4.17 <sup>c</sup>
SC (mm)	42.07±2.29 <sup>a</sup>	38.39±2.52 <sup>b</sup>	35.17±1.84 <sup>c</sup>
TL (mm)	118.58±6.96 <sup>a</sup>	111.12±4.83 <sup>b</sup>	106.47±5.49 <sup>c</sup>
TC (mm)	95.71±7.07 <sup>a</sup>	90.15±5.49 <sup>b</sup>	84.42±5.25 <sup>c</sup>
TFL (mm)	62.88±5.43 <sup>a</sup>	55.67±4.77 <sup>b</sup>	51.49±3.45 <sup>c</sup>
PBD (mm)	14.74±0.58 <sup>a</sup>	14.99±0.91 <sup>b</sup>	15.44±0.91 <sup>c</sup>

Note: Different letter superscripts on the same line for each type of chicken mean significantly different (P < 0.05), BL = Beak Length, BW = Beak Width (BW), HL = Head Length, HC = Head Circumference, HH = Head Height, NL = Neck Length, NC = Neck Circumference, WL = Wing Length, BL = Back Length, BH = Back Height, CL = Chest Length, CW = Chest Width, SL = Shank Length, SC = Shank Circumference, TL = Tibia Length, TC = Tibia Circle, TFL = Third Finger Length and PBD = Pubic Bone Distance.

Table 3. T2-Hotelling Test for local chicken body measurements

Body Measurements	Statistics T <sup>2</sup> Hotteling	F Value	P Value	Conclusion
KUB-S	375.9094	16.9681	0.00	**
KUB-A	1530.389	69.0800	0.00	**
S-A	826.1915	37.2934	0.00	**

Note: KUB = Kampung Unggul Balitnak chicken, S = Sentul chicken, A = Arab chicken. \*\* = Significantly Different (P<0,01).

Table 4. Equation determining determinant of body size and shape with total diversity and eigenvalue in chickens

Type		Equation	KT (%)	λ
KUB chicken	Body Size	= 0.256 BL + 0.239 BW + 0.206 HL + 0.177 HC + 0.245 HH + 0.244 NL + 0.243 NC + 0.241 WL + 0.176 BL + 0.174 BH + 0.250 CL + 0.259 CW + 0.262 SL + 0.223 SC + <b>0.263 TL</b> + 0.243 TC + 0.257 TFL + 0.253 PBD	61.60%	11.08
	Body Shape	= 0.132 BL + 0.301 BW – 0.118 HL – 0.426 HC – 0.149 HH – 0.350 NL – 0.287 NC – 0.113 WL + <b>0.379 BL</b> + 0.245 BH + 0.268 CL + 0.077 CW + 0.215 SL – 0.206 SC + 0.185 TL – 0.216 TC + 0.066 TFL – 0.030 PBD	6.70%	1.21
Sentul chicken	Body Size	= 0.243 BL + 0.200 BW + 0.187 HL + 0.234 HC + 0.250 HH + 0.243 NL + 0.246 NC + 0.216 WL + 0.230 BL + 0.227 BH + <b>0.262 CL</b> + 0.248 CW + 0.261 SL + 0.236 SC + 0.225 TL + 0.252 TC + 0.257 TFL + 0.208 PBD	72.90%	5.00
	Body Shape	= -0.111 BL – 0.453 BW – 0.646 HL + 0.023 HC + 0.124 HH + 0.085 NL – 0.031 NC + 0.289 WL + 0.027 BL – 0.059 BH + 0.177 CL + 0.002 CW + 0.029 SL – 0.052 SC + <b>0.389 TL</b> + 0.073 TC – 0.187 TFL + 0.164 PBD	13.11%	8.95
Arab chicken	Body Size	= 0.254 BL + 0.250 BW + 0.245 HL + 0.254 HC + 0.250 HH + 0,201 NL + 0,234 NC + 0,209 WL + 0.258 BL + 0.250 BH + <b>0.263 CL</b> + 0.258 CW + 0.258 SL + 0.239 SC + 0.221 TL + 0.203 TC + 0.194 TFL + 0.176 PBD	60.50%	7.30
	Body Shape	= -0.271 BL – 0.255 BW – 0.053 HL – 0.067 HC – 0.063 HH – 0.014 NL – 0.106 NC – 0.100 WL + 0.046 BL – 0.315 BH – 0.067 CL – 0.002 CW + 0.001 SL – 0.093 SC + 0.384 TL + <b>0.461 TC</b> + 0.417 TFL + 0.424 PBD	10.89%	1.31

Note: Different letter superscripts on the same line for each type of chicken mean significantly different (P <0.05), BL = Beak Length, BW = Beak Width (BW), HL = Head Length, HC = Head Circumference, HH = Head Height, NL = Neck Length, NC = Neck Circumference, WL = Wing Length, BL = Back Length, BH = Back Height, CL = Chest Length, CW = Chest Width, SL = Shank Length, SC = Shank Circumference, TL = Tibia Length, TC = Tibia Circle, TFL = Third Finger Length and PBD = Pubic Bone Distance.

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## Growth Patterns, Body Weight, and Morphometric of KUB Chicken, Sentul Chicken and Arab Chicken

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### ABSTRACT

The purpose of this research was to determine the body weight, weight gain and morphometric characteristics of several local chicken strains. The research materials were KUB chicken, Sentul chicken, and Arab chicken. The method used was an experiment with a sample of 82 chickens from each strain. Data collected include body weight, weight gain, beak length, beak width, head length, head circumference, head height, neck length, neck circumference, wing length, back length, back height, chest length, chest width, shank length, shank circumference, tibia length, tibia circumference, third finger length, and pubic bone distance. Data collected were analyzed using the average difference test (t-test). The average value vector of body measurements of chicken lines was analyzed using the *T<sup>2</sup>-Hotelling* (atau Hotelling diseragamkan) statistical test. Main Component Analysis statistical test was used to identify the shape and size characteristics of each chicken strain. The results showed that the body weight and morphometrics of KUB chickens at 3 months were significantly different ( $P < 0.05$ ) with Sentul chickens and Arab chickens. KUB chicken's body weight gain at 3 months was not significantly different ( $P > 0.05$ ) from Sentul chickens, but it was significantly different ( $P < 0.05$ ) from Arab chickens. Body weight, weight gain, and morphometrics of KUB chickens were higher than Sentul chickens and Arab chickens. The size indicator in KUB chickens was the tibia length while in Sentul chickens and Arab chickens was chest length. The characteristic of KUB chickens was the back length, Sentul chickens was tibia length, and Arab chickens was the shank circumference.

Keywords: Body weight, Weight gain, Body measures, KUB chicken, Sentul chicken, Arab chicken

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### Introduction

Indonesia is one of the countries with the most population, so the availability of both plant and animal food is very much needed. One of the livestock that can be used as a source of animal protein is chicken. Chicken is one of the livestock that is often raised by the people of Indonesia and provides a large enough role in meeting the needs of the animal protein community. Indonesia has dozens of strains of chicken that have the potential to be developed, one of which is local chicken. Local chickens are very well known by the people of Indonesia because of their very wide distribution area. Among the many local chickens in Indonesia, several strains that are tried to be developed are Sentul chickens, KUB chickens (Kampung Unggul Balitnak), and Arab chickens.

KUB chicken is the Superior Kampung chicken of the Indonesian Agency for Agricultural Research and Development which is the result of selection from a native chicken family for 6 generations (Hidayah *et al.*, 2019). KUB chickens are raised to produce eggs and meat production.

KUB chickens have promising prospects both economically and socially because it can supply the needs of highly nutritious food and have the absorption capacity of local and regional markets (Suryana, 2017).

Sentul chicken is one type of local chicken in Indonesia that has been recognized as germplasm of Ciamis Regency through Minister of Agriculture Decree No. 689/Kpts.PD41/ 2/2013 concerning the Determination of Sentul Chickens Clumps as Indonesian Local Clumps from Ciamis (Menteri Pertanian, 2013). Sentul chicken has the potential to be developed as meat and egg-producing chicken because it has good performance in terms of productivity.

Arab chickens originating from Belgium are also called *Kriel Braekels* which are included in the superior laying hens in Belgium. Arabic chicken is one of the native chickens that have been adapted in Indonesia (Gunawan *et al.*, 2018). Arab chickens initially received less attention from breeders, but now Arab chickens have begun to be developed and increased in production. Arab chicken is one type of egg-

producing chicken that is quite potential because of its high egg production resembling the productivity of laying hens. Arabian chickens are superior laying hens classified as light type chickens with a body weight of 40 weeks reaching 2.035g (Indra *et al.*, 2013).

Information about KUB chickens, Sentul chickens, and Arab chickens are not widely known, especially regarding their genetic potential. Genetic information is needed to determine the genetic quality of livestock which will be used as a material consideration in the selection and crossbreeding of local chickens in the future. Efforts can be made to obtain basic information about the genetic quality of livestock, it is necessary to do morphometric characterization of KUB chickens, Sentul chickens, and Arab chickens.

Morphometrics is a quantitative data collection activity that can be used to determine the level of livestock productivity, identification, and determinants of the characteristics of livestock which includes size and shape. Morphometric characteristics can be described by femur length, tibia length, maxilla length, wing length, tarsometatarsus length, tarsometatarsus circumference, third finger length (middle), and sternum length (Ashifudin *et al.*, 2017). Each type of chicken has unique characteristics both in size and body shape. Body measurements can be used to study animal growth and development. Morphometric measurements can also help the process of selection and crossbreeding between nations and types (Kurnianto *et al.*, 2013). The importance of this research is due to the lack of knowledge about morphometrics, especially in KUB chickens, Sentul chickens, and Arab chickens which can later be used as basic information for the development of local chickens in the future.

## Materials and Methods

The research material is KUB chickens, Sentul chickens, and Arab chickens that are kept from the age of DOC until the age of 3 months. The number of samples was 82 heads (41 males and 41 females) from each chicken strain. The equipment used is a digital caliper, digital scales capacity of 3 kg with an accuracy of 0.01 grams, measuring tape, digital cameras, stationery, 1 unit cage, place of feed and drink, commercial feed and drinking water, vaccines, and medicines.

The method used in this study was an experiment on body measurements and body weight of KUB chickens, Sentul chickens and Arabic chickens. The Chicken breeding system in a colony cage where each strain is placed in a different cage with other strains. The size of the cage used is 4 x 3 x 1.8 m which is equipped with a place to feed, drink, and lighting. Feeding and drinking are done continuously (*ad libitum*). Measurement of body measurements and body weight is done every month and every chicken that is measured is marked on the wings. Data collected includes body weight (BW),

weight gain (WG), and morphometrics of chickens. Variables measured include beak length (BL), beak width (BW), head length (HL), head circumference (HC), head height (HH), neck length (NL), neck circumference (NC), wing length (WL), back length (BL), back height (BH), chest length (CL), chest width (CW), shank length (SL), shank circumference (SC), tibia length (TL), tibia circumference (TC), third finger length (TFL) and pubic bone distance (PBD) based according to Koch (1973) and Sisson and Grossman. (1975).

Body Weight (BB) was measured by weighing chickens with digital scales (g). Beak Length (BL) between the base of the maxilla to the tip of the maxilla, as measured by a digital calipers (mm). Beak Width (BW) was measured from the outer half of the left and right, using a digital calipers (mm). Head Length (HL) was measured from the base of the beak to the rear of the head, using a digital calipers (mm). Head Circumference (HC) was measured at the highest part of the head by using a measuring tape (cm converted to mm). Head Height (HH) was measured at the highest part of the head using a digital calipers (mm). Neck Length (NL) was measured from the first cervical vertebrae to the last cervical vertebrae using a digital caliper (cm). Neck Circumference (NC) wraps around the measuring tape around the neck (cm converted to mm). Wing Length (WL) was measured from the humeral bone to the tip of the phalanges using a measuring tape (cm converted to mm). Back Length (BL) was measured from the tip of the neck to the base of the tail using a measuring tape (cm converted to mm). Back Height (BH) was measured from the bottom of the rests to the back using a ruler (cm converted to mm). Chest Length (CL) measurement of the length of the chest (sternum) was carried out from the front of the chest to the back of the chest using a digital caliper (mm). Chest Width (CW) measurement of chest width was obtained by measuring the distance from the left to the right (widest) sternal bone using a digital calipers (mm). Shank Length (SL) was measured along the tarsometatarsus bone (shank) using a digital caliper (mm). Circumference Shank (CS) around the measuring tape at the center of the tarsometatarsus bone (shank) (cm converted to mm). Tibia Length (TL) was measured from the patella to the tip of the tibia using a digital calipers (mm) Tibia Circumference (TC) wraps measuring tape around the tibia (cm converted to mm) Third Finger Length (TFL) was measured from the base to the tip of the third finger using a digital calipers (mm). Pubic Bone Distance (JTP) is measured using digital calipers (mm).

Data that has been collected include body weight and body measurements grouped by sex, then corrected to male measurements. After that continued with analyzed using the average difference test (t-test). The average value vector of the two sex groups includes BL, BW, HL, HC, HH, NL, NC, WL, BL, BH, CL, CW, SL, SC, TL, TC, TFL, PBD were analyzed using the  $T^2$ -Hotelling statistical test. Then do the statistical test to identify determinants of body shape and size in chickens using Principal Component Analysis (PCA) (Gaspersz, 2006). Data processing is

assisted by using Minitab statistical software version 18.

## Results and Discussion

### Local chicken body weight DOC-3 months

The average body weight of KUB chickens, Sentul chickens, and Arab chickens aged DOC up to 3 months are presented in Table 1. Based on Table 1 it can be seen that the average body weight of 3 months in KUB chickens is  $1108.42 \pm 84.52$  g, in Sentul chickens is  $1021.44 \pm 100.42$  g, while in Arab chickens is  $874.57 \pm 74.21$  g. The average body weight of KUB chickens in this study is higher than the results of Suryana (2017) research which states the average body weight of KUB chickens at 3 months is 750 g. The average body weight of Sentul chickens in this study was higher than Kurnia (2011) research which was 532.1 g. However, the average body weight of Sentul chickens in this study is lower than Habiburrahman *et al.* (2018) research in Pelung Sentul crossbreed chickens at 3 months of age is 1193.9 gr. The average body weight of Arab chickens in this study is higher than Nataamijaya *et al.* (2003) research with an average of 700 gr. This difference in results is thought to be due to genetic, environmental, and maintenance management differences. This is in accordance with the statement of Subekti and Arlina (2011) which states that differences in body size of chickens can be caused by different environmental conditions of the origin of the seeds and different maintenance environments, as well as genetic factors.

The results of the average difference test (t-test) showed that the DOC KUB chickens weight was not significantly different ( $P>0.05$ ) with Sentul chickens or Arab chickens, as well as Sentul chickens not significantly different ( $P>0.05$ ) with Arab chickens. Body weight at 1 month of age KUB chickens was significantly different ( $P<0.05$ ) with Sentul chickens and Arab chickens, while Sentul chickens body weight was not significantly different ( $P>0.05$ ) from Arab chickens. This is due to variations in the rate of growth between individuals in the form of slow growth at the beginning of the week which then increases at the end of maintenance. At 2 months KUB chickens were significantly different ( $P<0.05$ ) from Sentul chickens and Arab chickens, as well as Sentul chickens body weight significantly different ( $P<0.05$ ) from Arab chickens. Body weight at 3 months showed that KUB chickens were significantly different ( $P<0.05$ ) from Sentul chickens and Arab chickens, as well as Sentul

chickens significantly different ( $P<0.05$ ) from Arab chickens. Based on Table 1 it can be seen that the highest body weight at DOC age, 1 month, 2 months and 3 months is KUB chickens, while the lowest body weight is Arab chickens, it can be stated that KUB chicken has a higher body weight than Sentul chickens and Arab chickens. The differences in body weight are due to differences in genetics, seedling origin, and environmental adaptation. According to Zainal *et al.* (2012) the difference in body weight in livestock shows that each breed has a different ability in growth. This occurs due to differences in the ability to adapt to the environment which is an indication of the magnitude of environmental influence on the ability to grow.

### Weight gain of local chicken

The weight gain of KUB chickens, Sentul chickens, and Arab chickens at the age of DOC – 3 months are presented in Figure 1. Based on the different tests the average body weight gain of DOC KUB chickens was not significantly different ( $P>0.05$ ) with Sentul chickens and with Arab chickens. The weight gain of 1 - 2 months KUB chickens were significantly different ( $P<0.05$ ) with Sentul chickens and Arab chickens, as well as Sentul chickens body weight gain was significantly different ( $P<0.05$ ) with Arab chicken. Body weight gain of 2 - 3 months KUB chickens were not significantly different ( $P>0.05$ ) with Sentul chickens but significantly different ( $P<0.05$ ) from Arab chickens, while Sentul chickens body weight gain was significantly different ( $P<0.05$ ) with Arab chickens.

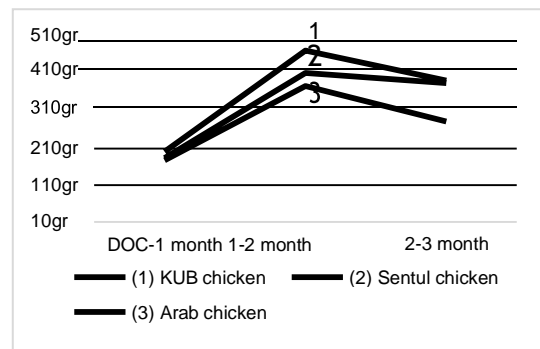


Figure 1. Graph of weight gain of local chicken bodies.

Figure 1 shows that the average weight gain of KUB chickens, Sentul chickens, and Arab chickens from DOC - 3 months of age in a row are KUB chickens was  $201.44 \pm 37.92$  g,  $477.51 \pm 56.75$  g, and  $395.27 \pm 103.09$  g. The average

Table 1. Average body weight of local chickens

Age	Local Chicken		
	KUB chicken	Sentul chicken	Arab chicken
DOC (g)	34.20±3.09 <sup>a</sup>	33.85 ±2.53 <sup>a</sup>	33.45±3.33 <sup>a</sup>
1 month (g)	235.64±38.63 <sup>a</sup>	217.06±42.88 <sup>b</sup>	210.50±35.28 <sup>b</sup>
2 months (g)	713.15±66.75 <sup>a</sup>	632.88±85.10 <sup>b</sup>	591.20±55.11 <sup>c</sup>
3 months (g)	1108.42±84.52 <sup>a</sup>	1021.44±100.42 <sup>b</sup>	874.57±74.21 <sup>c</sup>

Different letter superscripts on the same line for each type of chicken mean significantly different ( $P < 0.05$ ).

weight gain of Sentul chickens was  $183.21 \pm 42.91$  g,  $415.82 \pm 95.84$  g, and  $388.57 \pm 100.39$  g. While the average body weight gain of Arab chickens was  $177.04 \pm 36.55$  g,  $380.70 \pm 53.15$  g, and  $283.37 \pm 80.58$  g. The weight gain of KUB chickens, Sentul chickens, and Arab chickens continue to increase or grow rapidly at the age of 1 - 2 months and decrease at the age of 2 - 3 months. This is in line with the opinion of Urfa *et al.* (2017) which states the growth of chicken body weight will be fast and reach a specific weight at a young age.

Weight gain is an important factor to consider in observing chicken performance. KUB chickens have the highest body weight gain compared to Sentul chickens and Arab chickens both at the age of DOC - 1 month, 1 - 2 months and 2 - 3 months, which means livestock genetics can influence body weight growth. KUB chickens is a cross chicken from the selection of female Kampung chickens in West Java to increase livestock productivity through crossing between lines to get a high level of heterosis. This is consistent with the opinion of Daud *et al.* (2017) which states that one of the factors that can influence chicken body weight gain is the genetic factor of each chicken strain.

#### Morphometric characteristics of local chickens at 3 months

From the results of this study regarding the body measurements (morphometrics) of KUB chickens, Sentul chickens, and Arab chickens, the average and different test results are obtained based on the measured parameters as in Table 2.

Based on Table 2 the average difference test results showed that the body measurements of KUB chickens were significantly different

( $P < 0.05$ ) with Sentul chickens and Arab chickens, as well as the body measurements of Sentul chickens were significantly different ( $P < 0.05$ ) with Arab chickens. The highest average body measurements are KUB chickens, while the lowest average body measurements are Arab chickens. This means that KUB chickens have a higher meat production capability than Sentul chickens and Arab chickens. This indicates that KUB chickens are more directed to the broiler-type, although according to Suprijatna (2010) local chickens are dual-purpose chickens but can be selected for specific business purposes as the broiler or layer types. Selection towards meat-based on the body weight of chickens is shown by the properties of linear body surface size which are closely correlated with body weight. This difference in body size is thought to be a result of the genetic influence of livestock because the environmental conditions in which the research has been attempted are almost the same, so the real difference in body size parameters is thought to be caused by genetic diversity. Following the opinion of Rajab and Papilaya (2012) variations in chicken, body size can be caused by the influence of different genetic, environmental, and climatic conditions.

#### $T^2$ -Hotteling test

The  $T^2$ -Hotteling test was used to determine the similarities and differences in body measurements between the two groups of livestock.  $T^2$ -Hotteling test results of body size of KUB chickens, Sentul chickens, and Arab chickens can be seen in Table 3.

Based on  $T^2$ -Hotteling statistical test shows that the KUB chickens body measurements are significantly different ( $P < 0.01$ ) compared to Sentul

Table 2. Morphometric characteristics of local chickens at 3 months

Body Measurements	KUB chicken	Sentul chicken	Arab chicken
BL (mm)	$34.76 \pm 1.61^a$	$32.32 \pm 1.51^b$	$30.07 \pm 1.63^c$
BW (mm)	$7.84 \pm 0.50^a$	$7.08 \pm 0.69^b$	$6.37 \pm 0.54^c$
HL (mm)	$40.27 \pm 1.86^a$	$36.37 \pm 1.11^b$	$34.18 \pm 1.67^c$
HC (mm)	$32.30 \pm 2.10^a$	$30.25 \pm 1.66^b$	$28.52 \pm 1.56^c$
HH (mm)	$109.68 \pm 4.21^a$	$103.22 \pm 5.23^b$	$99.97 \pm 4.23^c$
NL (mm)	$125.83 \pm 5.24^a$	$117.27 \pm 6.69^b$	$96.78 \pm 5.80^c$
NC (mm)	$83.32 \pm 5.84^a$	$78.36 \pm 5.26^b$	$72.56 \pm 4.03^c$
WL (mm)	$190.07 \pm 6.42^a$	$180.02 \pm 7.40^b$	$172.69 \pm 6.47^c$
BL (mm)	$208.17 \pm 7.63^a$	$190.78 \pm 6.89^b$	$179.52 \pm 5.12^c$
BH (mm)	$265.76 \pm 8.50^a$	$241.50 \pm 8.58^b$	$227.42 \pm 5.75^c$
CL (mm)	$121.21 \pm 6.16^a$	$113.29 \pm 6.84^b$	$105.42 \pm 4.84^c$
CW (mm)	$56.39 \pm 4.31^a$	$52.30 \pm 3.13^b$	$48.58 \pm 4.50^c$
SL (mm)	$79.25 \pm 6.75^a$	$72.87 \pm 5.87^b$	$67.32 \pm 4.17^c$
SC (mm)	$42.07 \pm 2.29^a$	$38.39 \pm 2.52^b$	$35.17 \pm 1.84^c$
TL (mm)	$118.58 \pm 6.96^a$	$111.12 \pm 4.83^b$	$106.47 \pm 5.49^c$
TC (mm)	$95.71 \pm 7.07^a$	$90.15 \pm 5.49^b$	$84.42 \pm 5.25^c$
TFL (mm)	$62.88 \pm 5.43^a$	$55.67 \pm 4.77^b$	$51.49 \pm 3.45^c$
PBD (mm)	$14.74 \pm 0.58^a$	$14.99 \pm 0.91^b$	$15.44 \pm 0.91^c$

Different letter superscripts on the same line for each type of chicken mean significantly different ( $P < 0.05$ ), BL = Beak Length, BW = Beak Width (BW), HL = Head Length, HC = Head Circumference, HH = Head Height, NL = Neck Length, NC = Neck Circumference, WL = Wing Length, BL = Back Length, BH = Back Height, CL = Chest Length, CW = Chest Width, SL = Shank Length, SC = Shank Circumference, TL = Tibia Length, TC = Tibia Circle, TFL = Third Finger Length and PBD = Pubic Bone Distance.

Table 3.  $T^2$ -Hotteling Test for local chicken body measurements

Body Measurements	Statistics $T^2$ Hotteling	F Value	P Value	Conclusion
KUB-S	375.9094	16.9681	0.00	**
KUB-A	1530.389	69.0800	0.00	**
S-A	826.1915	37.2934	0.00	**

KUB = Kampung Unggul Balitnak chicken, S = Sentul chicken, A = Arab chicken. \*\* = Significantly Different ( $P < 0.01$ ).

Table 4. Equation determining determinant of body size and shape with total diversity and eigenvalue in chickens

Type	Equation	KT (%)	$\lambda$
KUB chicken	Body Size = $0.256 \text{ BL} + 0.239 \text{ BW} + 0.206 \text{ HL} + 0.177 \text{ HC} + 0.245 \text{ HH} + 0.244 \text{ NL} + 0.243 \text{ NC} + 0.241 \text{ WL} + 0.176 \text{ BL} + 0.174 \text{ BH} + 0.250 \text{ CL} + 0.259 \text{ CW} + 0.262 \text{ SL} + 0.223 \text{ SC} + \mathbf{0.263 \text{ TL}} + 0.243 \text{ TC} + 0.257 \text{ TFL} + 0.253 \text{ PBD}$	61.60%	11.08
	Body Shape = $0.132 \text{ BL} + 0.301 \text{ BW} - 0.118 \text{ HL} - 0.426 \text{ HC} - 0.149 \text{ HH} - 0.350 \text{ NL} - 0.287 \text{ NC} - 0.113 \text{ WL} + \mathbf{0.379 \text{ BL}} + 0.245 \text{ BH} + 0.268 \text{ CL} + 0.077 \text{ CW} + 0.215 \text{ SL} - 0.206 \text{ SC} + 0.185 \text{ TL} - 0.216 \text{ TC} + 0.066 \text{ TFL} - 0.030 \text{ PBD}$	6.70%	1.21
Sentul chicken	Body Size = $0.243 \text{ BL} + 0.200 \text{ BW} + 0.187 \text{ HL} + 0.234 \text{ HC} + 0.250 \text{ HH} + 0.243 \text{ NL} + 0.246 \text{ NC} + 0.216 \text{ WL} + 0.230 \text{ BL} + 0.227 \text{ BH} + \mathbf{0.262 \text{ CL}} + 0.248 \text{ CW} + 0.261 \text{ SL} + 0.236 \text{ SC} + 0.225 \text{ TL} + 0.252 \text{ TC} + 0.257 \text{ TFL} + 0.208 \text{ PBD}$	72.90%	5.00
	Body Shape = $-0.111 \text{ BL} - 0.453 \text{ BW} - 0.646 \text{ HL} + 0.023 \text{ HC} + 0.124 \text{ HH} + 0.085 \text{ NL} - 0.031 \text{ NC} + 0.289 \text{ WL} + 0.027 \text{ BL} - 0.059 \text{ BH} + 0.177 \text{ CL} + 0.002 \text{ CW} + 0.029 \text{ SL} - 0.052 \text{ SC} + \mathbf{0.389 \text{ TL}} + 0.073 \text{ TC} - 0.187 \text{ TFL} + 0.164 \text{ PBD}$	13.11%	8.95
Arab chicken	Body Size = $0.254 \text{ BL} + 0.250 \text{ BW} + 0.245 \text{ HL} + 0.254 \text{ HC} + 0.250 \text{ HH} + 0.201 \text{ NL} + 0.234 \text{ NC} + 0.209 \text{ WL} + 0.258 \text{ BL} + 0.250 \text{ BH} + \mathbf{0.263 \text{ CL}} + 0.258 \text{ CW} + 0.258 \text{ SL} + 0.239 \text{ SC} + 0.221 \text{ TL} + 0.203 \text{ TC} + 0.194 \text{ TFL} + 0.176 \text{ PBD}$	60.50%	7.30
	Body Shape = $-0.271 \text{ BL} - 0.255 \text{ BW} - 0.053 \text{ HL} - 0.067 \text{ HC} - 0.063 \text{ HH} - 0.014 \text{ NL} - 0.106 \text{ NC} - 0.100 \text{ WL} + 0.046 \text{ BL} - 0.315 \text{ BH} - 0.067 \text{ CL} - 0.002 \text{ CW} + 0.001 \text{ SL} - 0.093 \text{ SC} + 0.384 \text{ TL} + \mathbf{0.461 \text{ TC}} + 0.417 \text{ TFL} + 0.424 \text{ PBD}$	10.89%	1.31

Different letter superscripts on the same line for each type of chicken mean significantly different ( $P < 0.05$ ). BL = Beak Length, BW = Beak Width (BW), HL = Head Length, HC = Head Circumference, HH = Head Height, NL = Neck Length, NC = Neck Circumference, WL = Wing Length, BL = Back Length, BH = Back Height, CL = Chest Length, CW = Chest Width, SL = Shank Length, SC = Shank Circumference, TL = Tibia Length, TC = Tibia Circle, TFL = Third Finger Length and PBD = Pubic Bone Distance.

chickens and Arab chickens, Sentul chickens body measurements are significantly different ( $P < 0.01$ ) from Arab chickens. Differences in livestock body size are thought to be caused by genetic differences. This is following the opinion of Hikmawaty *et al.* (2014) which states that livestock body sizes may differ from one another due to the possibility of differences in diversity due to genetic potential, origin location, maintenance, and mating systems applied in the area. Based on the T2-Hotelling test it can be concluded that KUB chickens have the largest body measurements compared to Sentul chickens and Arab chickens, while Arab chickens have the smallest body measurements.

### Principal component analysis

The equations determining the size and shape, total diversity, and eigenvalues of KUB chickens, Sentul chickens, and Arab chickens at 3 months based on principal component analysis are presented in Table 4. Based on the results of the size equation in Table 4, it can be seen that the total diversity of the first main component which is equalized with the size of the KUB, Sentul and Arab chickens respectively are 61.60%, 72.90% and 60.50% with Eigenvalue 11.08, 5.00 and 7.30. The total diversity of the second main components which is equal to the form in KUB chickens, Sentul chickens, and Arab chickens respectively are 6.70%, 13.11%, and 10.89% with Eigenvalues 1.21, 8.95, and 1.31.

Variable body measurements that affect the size identifier in KUB chickens are TL but Sentul and Arab chickens are CL. This means that the length of the tibia and chest length is a measure of size in KUB chickens, Sentul chickens, and Arab chickens because it has the largest contribution to the size score in the body size equation.

Variable body measurements of KUB chickens, Sentul chickens, and Arab chickens that influence the shape identifiers respectively are BL, TL, and TC. This means that the back length, the

length of the tibia, and the circumference of the shank are the hallmarks of the shape of the chicken because it has the largest contribution to the shape equation. This is following the opinion of Candrawati (2007) argues that identification is done by finding the characteristics of each type of local chicken based on the size and shape which is calculated by the statistical method of Principal Component Analysis (PCA). The shape is strongly influenced by genetics, while the size is more influenced by the environment or regional topography. Analysis of the Principal component (PCA) is one way to find out the discrimination between the size and body shape of chickens. Mariandayani *et al.* (2013) added that the analysis of the main components of phenotypic parameters can be used to determine morphometric parameters that indicate the nation's markers and are referred to as the nation's differentiator variables.

### Conclusions

Body weight, weight gain, and body measurements of KUB chickens are higher than Sentul chickens and Arab chickens. The highest weight gain from DOC - 3 months of KUB chickens, Sentul chickens, and Arab chickens were at 1 - 2 months. The size indicator of KUB chickens was tibia length while in Sentul chickens and Arab chickens were chest length. The shape indicator of KUB chickens is back length, Sentul chickens is tibia length, and Arab chicken is the shank circumference.

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## References

- Ashifudin, E. Kurnianto, and Sutopo. 2017. Karakteristik morfometrik ayam kedu jengger merah dan jengger hitam generasi pertama di satker ayam maron-temanggung. *Jurnal Ilmu Ternak* 17: 40–46.
- Candrawati, V. Y. 2007. Studi ukuran dan bentuk tubuh ayam kampung, ayam sentul dan ayam wareng tangerang melalui analisis komponen utama. Skripsi Institut Pertanian Bogor, Bogor.
- Daud, M., Z. Fuadi, and Mulyadi. 2017. Performa dan persentase karkas ayam ras petelur jantan pada kepadatan kandang yang berbeda. *Agripet*. 17: 67-74.
- Gaspersz, V. 2006. Teknik Analisis dalam Penelitian Percobaan. Penerbit. Tarsito Bandung.
- Gunawan, E., D. Kaharuddin, dan Kususiya. 2018. Performans keturunan ayam arras dengan ayam arab (ayam ketarras) umur 2-12 minggu performance. *Jurnal Sain Peternakan Indonesia*. Vol. 13 No. 1 Hal. 89–100.
- Habiburrahman, R., S. Darwati, and C. Sumantri. 2018. Pola pertumbuhan ayam silangan pelung sentul kampung ras pedaging (IPB D-1) g4 umur 1-12 minggu. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 6: 81-89.
- Hikmawaty, A. Gunawan, R. R. Noor, and Jakaria. 2014. Identifikasi ukuran tubuh dan bentuk tubuh sapi bali di beberapa pusat pembibitan melalui pendekatan Analisis Komponen Utama. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 02: 231-237.
- Hidayah, R., I. Ambarsari, and Subiharta. 2019. Kajian sifat nutrisi, fisik dan sensori daging ayam KUB di jawa tengah. *Jurnal Peternakan Indonesia* 21: 93-101.
- Indra, G. K., Achmanu, and A. Nurgiantiningsih. 2013. Performans produksi ayam Arab (*gallus turcicus*) berdasarkan warna bulu. *Jurnal Ternak Tropika* 14: 8-14.
- Keputusan Menteri Pertanian. 2013. Penetapan Rumpun Ayam Sentul. Indonesia, Jakarta.
- Koch, T. 1973. Anatomy of the Chicken and Domestic Bird. The Iowa State University Press, Iowa.
- Kurnia, Y. 2011. Morfometrik ayam Sentul, Kampung dan Kedu pada fase pertumbuhan dari umur 1-12 minggu. Skripsi Institut Pertanian Bogor, Bogor.
- Kurnianto, E., S. Sutopo, E. Purbowati, E.T. Setiatin, D. Samsudewa and T. Permatasari. 2013. Multivariate analysis of morphological traits of local goats in Central Java-Indonesia. *Iranian Journal of Applied Animal Science* 3: 361- 367.
- Mariandayani, H. N., D. D. Solihin, S. Sulandari, and C. Sumantri. 2013. Keragaman fenotipik dan pendugaan jarak genetik pada ayam lokal dan ayam broiler menggunakan analisis morfologi. *Jurnal Veteriner* 14: 475-484.
- Nataamijaya, A. G., A. R. Setioko, B. Brahantiyo, and K. Diwyanto. 2003. Performans dan karakteristik tiga galur ayam lokal (Pelung, Arab, dan Sentul). *Puslitbang Peternakan*, Bogor. 353-359.
- Rajab and B. J. Papilaya. 2012. Sifat kuantitatif ayam kampung lokal pada pemeliharaan tradisional. *Agrinimal* 2: 61-64.
- Sisson dan Grossman. 1975. The Anatomy of the Domestic Animals. 5th ed. W. B. Saunders. Co Philadelphia.
- Subekti, K. and F. Arlina. 2011. Karakteristik genetik eksternal ayam kampung di kecamatan sungai pagu kabupaten solok selatan. *Jurnal Ilmiah Ilmu-Ilmu Peternakan* 14: 74-86.
- Suprijatna, E. 2010. Strategi pengembangan ayam lokal berbasis sumber daya lokal dan berwawasan lingkungan. Prosiding Seminar Nasional Unggas Lokal ke IV. Fakultas Peternakan Universitas Diponegoro, Semarang.
- Suryana. 2017. Pengembangan ayam Kampung Unggul Balitbangtan (KUB) di Kalimantan Selatan. *Wartazoa* 27: 45-52.
- Urfa, S., H. Indijani, and W. Tanwiriah. 2017. Model kurva pertumbuhan ayam kampung unggul balitnak (KUB) umur 0-12 minggu. *Jurnal Ilmu Ternak* 17: 59–66.
- Zainal, H., T. Sartika, D. Zainuddin, and Komarudin. 2012. Persilangan pada ayam lokal (kub, sentul, gaok) untuk meningkatkan produksi daging unggas nasional. Workshop Nasional Unggas Lokal. 102-108.





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28 Agustus 2020

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Dengan hormat,

Diberitahukan bahwa naskah yang berjudul **Growth Patterns, Body Weight, and Morphometric of KUB Chicken, Sentul Chicken and Arab Chicken**, dengan susunan penulis: **Nabilah Ika Puteri, Gushairiyanto, and Depison**, akan diterbitkan di Buletin Peternakan Volume 44 (3) Edisi Agustus 2020.

Berikut ini kami infromasikan rincian biaya untuk naskah tersebut:

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Atau dapat dibayarkan langsung kepada Bpk. Muhlisin, S.Pt., M.Agri., Ph.D., Bagian Lab. Biokimia Nutrisi, Fakultas Peternakan UGM.

Demikian surat pemberitahuan ini kami buat. Atas perhatian dan kerjasamanya, kami mengucapkan banyak terima kasih.

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