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Comparison of the Morphometric Traits and Body Weight of Pure Kampung Chicken with Kampung-Bangkok Crosses Chicken

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ABSTRACT: Efforts that can be made to improve the performance of native chickens are by crossing them with Bangkok chickens. The results of crosses between Kampung chickens and Bangkok chickens are expected to pass down good growth genes. This study used 66 chickens consisting of 33 pure Kampung chickens and 33 chickens from the Kampung x Bangkok cross-reared from DOC until the age of eight weeks. Every week body weights and measurements of body parts are carried out. This study was analyzed using the T-test to compare the performance of chickens from the Kampung x Bangkok cross with native chickens. Body weights between native chickens and Kampung x Bangkok crosses were significantly different at the age of DOC (0 weeks) and the age of 3 to 8 weeks. Body length and height of free-range chickens with Kampung x Bangkok crosses were different at the age of DOC up to 2 weeks. Chest width was different between native chickens and Kampung x Bangkok crosses at DOC to 1 week of age. The Shank length and shank circumference of native chickens with Kampung x Bangkok crosses were different at all ages. The tibia length of free-range chickens with the Kampung x Bangkok cross was different at DOC up to 6 weeks of age. The tibia circumference of free-range chickens with Kampung x Bangkok crosses differed from DOC to 4 weeks of age.

Keywords: Kampung chickens; Crossbreeding; Morphometric; Body weight

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INTRODUCTION

Local chicken is one of the potential sources of animal protein for the people of Indonesia. Some advantages of local chickens are that they can survive and breed well despite low feed quality and resistance to disease. The utilization of local Indonesian chicken needs to be done optimally to help provide animal protein for the people of Indonesia. Kampung and Bangkok chickens are local chickens that are pretty popular in Indonesia.

Free-range chickens have a relatively high diversity of phenotypes and genotypes, characterized by varied coat colors and production performance. The advantages of free-range chicken are that it is resistant to disease and environmental heat stress and has meant that the people of Indonesia prefer it because of its delicious taste compared to purebred chicken. Indonesian people keep Bangkok chickens as fighting chickens with more significant and upright body characteristics when compared to native chickens. This shows that Bangkok chicken has the potential to be used as broilers. Crossing local chickens with Bangkok is expected to increase the productivity of local chickens in Indonesia. Based on this, efforts can be made to improve the performance of native chickens, namely by crossing (hybridizing) with Bangkok chickens. The results of crossing Kampung chickens with Bangkok chickens are expected to pass down genes for good growth, high reproduction, high egg production, and good meat quality.

Crossbreeding increases the heterozygosity of non-additive genes that cause heterosis (Keambou et al., 2010). Hybridization events are widespread and can result in heterosis, phenotypic novelty, and specific changes in production performance in F1 hybrids. These phenomena can be attributed to different magnitudes and directions of gene expression (Gu et al., 2019). Crossbreeding results in changes in genetic variants and allows the incorporation of valuable traits from the parental line in the offspring; heterosis is essential for body weight at different life periods in chickens (Lalev et al., 2014). Most chicken breeding programs in developing countries currently rely on phenotypic and morphometric traits (Otecko et al., 2019). Phenotypic and morphometric approaches are fundamental in chicken breed management in resource-poor settings because they are simple, fast, and cost-effective (Dorji & Sunar, 2014). This study aims to see the differences in body morphometrics of pure native chickens with the results of crosses between Kampung and Bangkok chickens.

MATERIALS AND METHODS

Materials

This study used 33 chickens from crosses between Kampung and Bangkok and 33 pure Kampung chickens. The chickens used in this study were reared from DOC (day-old chick) to eight weeks of age. The feed given is broiler feed from PT. Japfa Comfeed, Tbk. Drinking water is provided ad libitum. The equipment used in this research is a measuring tape, a digital camera, boots, digital scales, a calculator, and tools to fill in the raw data.

Research procedure

The procedure for this research was 66 chickens consisting of 33 pure Kampung chickens and 33 chickens from the Kampung X Bangkok cross-reared from DOC until the age of eight weeks. Every week body weights and measurements of body parts are carried out.

Research Parameters

The parameters observed in this study consisted of the following;

1. Weight of DOC (grams), the weight of one week of age (grams), the weight of two weeks of age (grams), the weight of three weeks of age (grams), the weight of four weeks of age (grams), the weight of five weeks of age (grams), the weight of age six weeks (grams), seven weeks of age (grams), and eight weeks of age (grams).

2. The size of the chicken body parts from DOC to eight weeks of age consisting of; height, body length, chest width, chest circumference, shank length, shank circumference, tibia length, tibia circumference,

   a. Height: Height is measured by measuring the distance between the legs and the shoulders using a ruler.
   b. Body Length: body length measurement is done by measuring the distance between the last cervical vertebrae and the caudal vertebrae
   c. Chest circumference: chest circumference measurement is done by circling the thread from the back to the chest. The thread is then measured using a measuring tape.
   d. Chest width: chest width measurement is done by measuring the distance between the right side of the chest and the left side of the chest using a caliper
   e. Tibia Length: The length of the lower thigh is measured by measuring the distance between the base and the tip of the lower thigh bone (tibia).
   f. Tibia Circumference: measurement of tibia circumference is done by wrapping a thread on the tibia (lower thigh) and then measured using a measuring tape
   g. Shank Length: measured by measuring between the ends of the shank using a caliper.
   h. Shank circumference: Shank circumference is measured by wrapping a measuring tape in the center of the shank bone (cm).

Data analysis

This study was analyzed using the T-test to compare the performance of chickens from the Kampung x Bangkok cross with native chickens. This study was analyzed using an independent sample T-test using SPSS 16 software. Pearson correlation test examines the relationship between body weight and several morphometric parameters using SPSS 16

RESULT AND DISCUSSION

Live body weight

The body weight of Kampung chickens and Kampung-Bangkok crosses was significantly different at the age of DOC (0 weeks) and the age of 3 to 8 weeks at $P<0.05$ (Figure 1). The body weight of Kampung-Bangkok crosses chickens was higher than that of Kampung chickens. At the age of 8 weeks, the bodyweight of Kampung chickens was 627.13 g, which was lower than that of Kampung-Bangkok crosses chickens, 727,93 g. In contrast, Rahayu et al. (2010) found a difference in the body weight of Kampung-Bangkok crosses (611.5 g) and Bangkok x Kampung chickens at eight weeks of age. The Kampung-Bangkok crosses chickens generally have a higher body weight than the Kampung chickens, which probably indicates that crossing Kampung chickens with Bangkok chickens can increase their productivity.

Body length and height

There were differences in body length between Kampung chickens with Kampung-Bangkok crosses chickens from DOC up to two weeks of age. However, no difference was observed in body length between the Kampung chickens with Kampung-Bangkok crosses from three weeks of age (Table 1). Kampung-Bangkok crosses chickens from 3 weeks' age (Table 2).

Chest width and circumference

The chest width differed between Kampung, and Kampung-Bangkok crosses chickens at the age of DOC to one week of age. However, it was not different from 2 weeks of age (Figure 4). The chicken chest is the main element in meat growth. The chest size is used to determine the quality of the meat because most of the muscle, which is the biggest carcass issue, is around the chest (Lisnahan, 2017). Bone growth can affect body length and weight, while meat increase affects chest width, chest circumference, and body weight (Lisnahan

et al., 2020). The chest width in this study is similar to the chest width of nunukan chickens in preceding studies, which is a 6.56 cm decrease from the chest width of pelung, merawang, kedu and gaga chickens (Maharani et al., 2021).

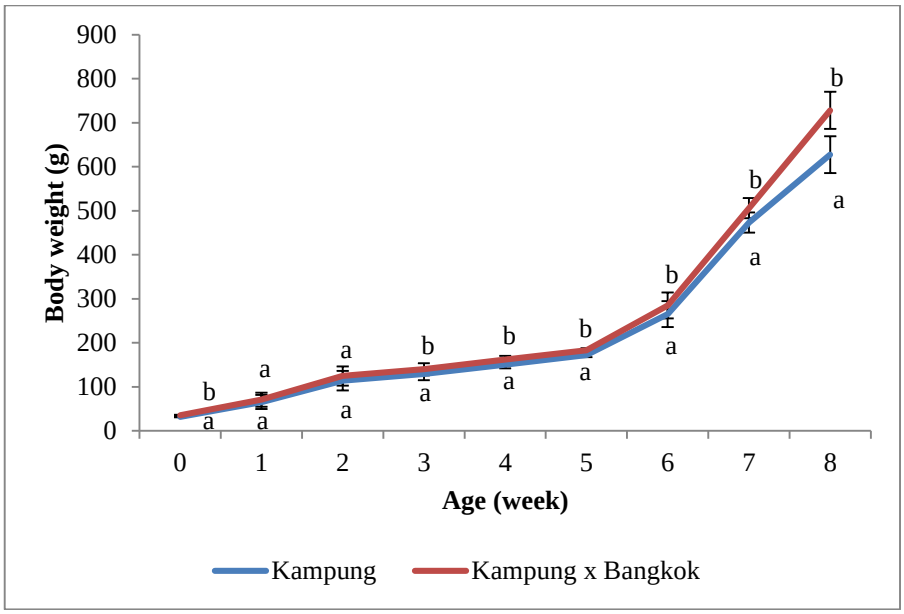

Figure 1. Body weight of Kampung chickens and the Kampung-Bangkok crosses chicken

Table 1. The body length of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Body length (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	5.19±0.67[a]	6.21±0.67[b]
1	6.75±0.67[a]	7.67±0.67[b]
2	9.01±1.45[a]	9.98±1.42[b]
3	10.16±1.54[a]	10.53±1.50[a]
4	10.74±1.55[a]	11.12±1.50[a]
5	11.27±1.58[a]	11.66±1.52[a]
6	13.56±1.79[a]	13.85±1.78[a]
7	15.05±1.23[a]	15.41±1.21[a]
8	16.54±1.47[a]	16.96±1.50[a]

Note: Different superscripts in the same row show significant differences (P <0.05)

Table 2. The height of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Height (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	5.82±0.62[a]	6.84±0.62[b]
1	8.19±1.25[a]	9.10±1.23[b]
2	10.30±1.61[a]	11.33±1.58[b]
3	11.58±1.78[a]	12.06±1.75[a]
4	12.40±2.03[a]	12.83±2.02[a]
5	13.15±2.35[a]	13.56±2.34[a]
6	15.05±2.48[a]	15.48±2.54[a]
7	19.00±1.60[a]	19.35±1.62[a]
8	22.95±2.08[a]	23.31±2.05[a]

Note: Different superscripts in the same row show significant differences (P <0.05)

Table 3. The chest width of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Chest width (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	3.23±0.47[a]	3.58±0.40[b]
1	3.90±0.53[a]	4.26±0.48[b]
2	4.31±0.64[a]	4.65±0.59[b]
3	4.46±0.62[a]	4.81±0.56[b]
4	4.68±0.66[a]	5.02±0.61[b]
5	4.89±0.72[a]	5.22±0.66[a]
6	5.93±0.88[a]	6.30±0.84[a]
7	6.20±0.72[a]	6.56±0.66[a]
8	6.47±1.02[a]	6.83±0.97[a]

Note: Different superscripts in the same row show significant differences (P <0.05)

Table 4. The chest circumference of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Chest circumference (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	10.73±1.07	11.09±1.00
1	12.91±1.73	13.26±1.70
2	14.45±1.80	14.78±1.77
3	15.04±1.67	15.38±1.63
4	15.83±1.41	16.14±1.40
5	16.53±1.27	16.85±1.23
6	20.06±3.48	20.38±3.42
7	21.53±2.08	21.87±2.07
8	22.99±1.98	23.34±1.97

The height of Kampung chickens and Kampung-Bangkok crosses chickens differed from the age of DOC to 2 weeks of age. However, there was no difference in height between Kampung chickens and no difference was observed between the chest circumference of Kampung chickens and Kampung-Bangkok crosses chickens of all ages. The chest circumference size continued to increase with age (Table 3). The part of the chicken body that responds to food quality and quantity is the chest muscle and followed by the thigh muscle (Kita et al., 2002)

Shank length and circumference

There were differences in the shank length of Kampung chickens and Kampung-Bangkok crosses chickens of all ages. The shank of the Kampung-Bangkok crosses chicken is longer than the Kampung chicken at all ages (Table 5).

These findings are similar to Yeasmin and Howlider (2013), who stated that the shank length differed significantly between genotypes at all ages of chickens, regardless of sex, and differences between genotypes increased with older age. Previous reports stated that the length of the Bangkok chicken shank is longer than the shank length of Kampung chickens (Sitanggung et al., 2015). Suk (2004) stated that there is a relationship between the overall average birth weight and the average length of the broiler shank.

Table 5. The shank length of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Shank length (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	1.70±0.19[a]	2.06±0.13[b]
1	2.36±0.19[a]	2.70±0.20[b]
2	3.06±0.19[a]	3.41±0.18[b]
3	3.74±0.24[a]	4.12±0.24[b]
4	4.43±0.31[a]	4.80±0.32[b]
5	5.11±0.39[a]	5.47±0.40[b]
6	5.81±0.46[a]	6.15±0.48[b]
7	6.49±0.54[a]	6.85±0.57[b]
8	7.18±0.62[a]	7.53±0.65[b]

Note: Different superscripts in the same row show significant differences (P <0.05)

Table 6. The shank circumference of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Shank circumference (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	1.70±0.18[a]	2.04±0.07[b]
1	1.93±0.18[a]	2.28±0.08[b]
2	2.17±0.18[a]	2.52±0.09[b]
3	2.40±0.18[a]	2.74±0.10[b]
4	2.62±0.20[a]	2.98±0.13[b]
5	2.86±0.22[a]	3.21±0.15[b]
6	3.09±0.24[a]	3.45±0.18[b]
7	3.33±0.26[a]	3.68±0.21[b]
8	3.56±0.28[a]	3.91±0.23[b]

Note: Different superscripts in the same row show significant differences (P <0.05)

There were differences in the shank circumference of Kampung chickens and Kampung-Bangkok crosses chickens at all ages (Table 6). The Kampung-Bangkok crosses chickens had wider shank circumference at DOC (2.04±0.07 cm) and eight weeks of age (3.91±0.23 cm). Previous reports stated that the shank circumference of Bangkok chicken (6.88 cm) was higher than that of the Kampung chicken (5.05 cm) (Sitanggung et al., 2015).

Tibia length and circumference

There were differences in the tibia length of Kampung chickens and Kampung-Bangkok crosses chickens from DOC up to 6 weeks of age (Figure 8). These results are from a previous study that described that the tibia length of Bangkok chickens is higher than that of Kampung chickens (Sitanggung et al., 2015).

There were differences between the tibia circumference of Kampung chickens and Kampung-Bangkok crosses chickens at DOC up to 4 weeks of age, but were not from 5 weeks of age (Figure 9). This is because the composition and structure of the tibia bone are based on the age of the chicken (Sanchez-Rodriguez et al., 2019)

Sophia et al. (2021) stated that the number of gene pairs (polygenes) and the environment could affect the body's morphometric phenotype. In addition, according to Young et al. (2017), morphometrics is also influenced by developmental factors. Meanwhile, Felice and Goswami (2018) and Bright et al. (2016) stated that domestication factors also influence the morphometric diversity of poultry.

Table 7. The tibia length of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Tibia length (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	2.53±0.05[a]	2.88±0.05[b]
1	3.42±0.37[a]	3.78±0.37[b]
2	4.34±0.31[a]	4.69±0.27[b]
3	5.20±0.40[a]	5.53±0.36[b]
4	6.04±0.50[a]	6.42±0.48[b]
5	6.90±0.61[a]	7.21±0.58[b]
6	7.76±0.72[a]	8.14±0.71[b]
7	8.61±0.83[a]	9.00±0.84[a]
8	9.47±0.94[a]	9.86±0.95[a]

Note: Different superscripts in the same row show significant differences (P <0.05)

Table 8. The tibia circumference of the Kampung chicken and the Kampung-Bangkok crosses chicken

Age (week)	Tibia circumference (cm) (mean ± SD)	
	Kampung	Kampung-Bangkok crosses
DOC	2.84±0.32[a]	3.20±0.30[b]
1	3.33±0.26[a]	3.67±0.24[b]
2	3.81±0.34[a]	4.13±0.33[b]
3	4.28±0.42[a]	4.61±0.38[b]
4	4.76±0.53[a]	5.08±0.48[b]
5	5.23±0.63[a]	5.54±0.58[a]
6	5.70±0.74[a]	6.00±0.69[a]
7	6.17±0.84[a]	6.50±0.80[a]
8	6.64±0.95[a]	6.96±0.90[a]

Note: Different superscripts in the same row show significant differences (P <0.05)

Correlation of several parameters morphometric to body weight

The body length, height, chest width, and chest circumference at various ages were strongly correlated to a perfect correlation with body weight. The positive correlation coefficient shows that an increase in body length, height, chest width, and chest circumference is accompanied by an increase in body weight.

The result by Semaula et al. (2011) that chest circumference is the most accurate estimate of body weight. Similarly, Ige (2014) reported that chest circumference is a reliable trait in genetic studies because it is a good predictor of body weight. As well as, Lisnahan et al. (2020) stated that there was a positive correlation between chest circumference and body weight of native chickens. This result is in line with Assefa and Melesse's (2018) research that there is a high correlation between body weight and body circumference in local Ethiopian chickens. The results of Abdel-Latif's research (2019) indicate a significant correlation between body weight, chest circumference, shank length, and shank diameter in leghorn chickens. Alshemery (2014) observed a positive correlation between chest circumference, carcass weight, and body length. Likewise, Ukwu et al. (2014) found a significantly high correlation between body weight, chest circumference, thigh length, and shank length in local Nigerian chickens. The DOC length can be used for selection criteria for chicks that have good growth performance (Petek et al., 2010). Chick length significantly affects broiler body weight up to 6 weeks of age (Patbandha et al., 2017).

Table 9. Correlation of several parameters morphometric with the body weight of Kampung-Bangkok crosses chickens

Age (week)	Coefficient correlation (r)							
	Body length	Body height	Breast width	Breast circumference	Shank length	Shank size	Tibia length	Tibia size
DOC	0.09 ^{ns}	0.11 ^{ns}	0.24 ^{ns}	0.10 ^{ns}	-0.32 ^{ns}	-0.08 ^{ns}	0.06 ^{ns}	0.15 ^{ns}
1	0.81**	0.81**	0.82**	0.90**	0.13 ^{ns}	0.21 ^{ns}	0.21 ^{ns}	-0.21 ^{ns}
2	0.78**	0.86**	0.73**	0.80**	0.06 ^{ns}	0.13 ^{ns}	0.19 ^{ns}	-0.37*
3	0.59**	0.74**	0.57**	0.66**	0.09 ^{ns}	0.09 ^{ns}	0.34 ^{ns}	-0.39*
4	0.85**	0.92**	0.75**	0.78**	0.06 ^{ns}	0.06 ^{ns}	0.13 ^{ns}	-0.39*
5	0.98**	0.79**	0.90**	0.89**	-0.09 ^{ns}	-0.07 ^{ns}	0.02 ^{ns}	-0.31 ^{ns}
6	0.58**	0.81**	0.53**	0.43*	0.12 ^{ns}	0.10 ^{ns}	0.21 ^{ns}	-0.33 ^{ns}

Shank length, shank circumference, tibia length, and tibia circumference in this study generally did not correlate significantly with body weight. These results differ from previous reports showing a strong positive correlation between shank length and body weight in intensively managed Bangladesh native chickens (Faruque et al., 2010). A high correlation between body weight and shank length was also reported in local Sri Lankan chickens (Liyanage et al., 2015).

High and positive phenotypic correlations between body weight were also found in Rhode Island chickens (Kabir et al. (2006). Likewise, Patbandha et al. (2017) report that shank length affects the body weight of broilers aged two weeks. Ose - Amponsah et al. (2013) reported a high genotypic and phenotypic correlation between the shank length and body weight of local Ghanaian chickens. Shank length and shank diameter have a positive correlation with body weight which determines body composition (Lisnahan et al., 2020).

CONCLUSIONS

In conclusion, shank length, tibia CIRCUMFERENCE, TIBIA LENGTH, AND BODY WEIGHT WERE GENERALLY HIGHER IN Kampung-Bangkok crosses chickens when compared to pure Kampung chickens.

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