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Growth Rate, Carcass Weight and Percentage Weight of Carcass Parts of Laying Type Cockerels, Kampong Chicken and Arabic Chicken in Different Ages

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Abstract: This study was designed to determine the effect of age of laying-type cockerels, kampong chicken and arabic chicken on growth performance, carcass weight and the percentage weight of carcass parts. The experiment was designed in a Complete Randomized Design with 3 x 7 factorial arrangements. The first factor was types or lines of chicken consisted of 3 levels i.e., laying-type cockerels, kampong chicken and arabic chicken. The second factor was age of slaughtering consisted of 7 levels i.e., at the ages of 4, 5, 6, 7, 8, 9 and 10 weeks. The study used 63 day old chick (DOC) laying-type cockerels, 63 unsexed DOC kampong chickens and 63 unsexed DOC arabic chickens. Each line of chicken was divided into 9 groups consisted of 7 chicks. Every group was kept in a one meter cubic cage. Every weekend, feed intake and body weight were measured. At the end of the fourth week, from each group, one chicken was randomly selected for measurement of live weight, carcass weight and the percentage weight of carcass part. The results of the study found that laying-type cockerel, kampong chicken and arabic chicken had the same feed intake and feed efficiency, but had different body weight gains, carcass weights and the percentage weight of carcass parts (drumstick, thighs, wings, breast and back). The increase of age affected feed intake, body weight gain, feed efficiency, carcass and the percentage weight of carcass part. There was an interaction between the line of chicken and age on body weight gain, but there was no interaction on feed intake, feed efficiency, carcass weight and the percentage weight of carcass part (drumstick, thighs, wings, breast and back).

Key words: Laying-type cockerels, kampong chicken, arabic chicken, body weight, carcass

INTRODUCTION

Due to the limitation in supply of kampong chicken for Indonesian traditional food ingredients, there is a shift of chicken usage to arabic chicken and laying-type cockerels. Kampong chicken is a native Indonesian chicken. Kampong chicken has some particular features like distinctive flavor, especially for Indonesian traditional cuisine. In addition, kampong chicken also has the ability to live and thrive with simple raising and management systems, such as feeding them directly with domestic or agricultural wastes. Furthermore, it has been proven that kampong chicken is very adaptive to live in humid and hot tropical environment (Tamzil *et al*., 2013ab; Tamzil *et al*., 2014; Tamzil, 2014). However, kampong chicken has low egg production (Nishida *et al*., 1980; Iskandar *et al*., 2000). Therefore, the major obstacle in increasing the population of kampong chicken is the low egg production. Arabic chicken is a local laying hen originated from Braekel chicken (*Gallus turnicus*), which at a later stage is known as the arabic chicken (Sulandari *et al*., 2007ab; Sartika and Iskandar, 2007). Compared to the kampong chicken, arabic chicken has higher egg production. Hence there is no limitation in increasing population of arabic chicken. The growth rate of arabic chicken is relatively higher than that of kampong chicken, but lower than that of laying-type cockerels (Tamzil *et al*., 2013a). Arabic chicken also has a relatively similar adaptability to humid and hot tropical environment as kampong chicken (Tamzil *et al*., 2013ab; Tamzil *et al*., 2014; Tamzil, 2014). Thus, arabic chicken is suitable to be developed in humid tropical regions such as the island of Lombok. On the other hand, a laying-type cockerel which was originally a hatchery waste that was not used, lately begins to be used as one of the poultry meat providers. Scientific data on growth, carcass and carcass part of local chicken are very limited (Tadelle *et al*., 2000), while in other types of poultry such as the pekin duck (Bochno *et al*., 2005), muscovy ducks (Bochno *et al*., 2005), broilers (Bochno *et al*., 2003) and laying-type cockerels (Murawska *et al*., 2005) have been reported. Therefore, this study was conducted in an effort to obtain a comparison of growth and carcass characteristics of local Indonesian chickens (kampong chickens and arabic chicken) and laying-type cockerels.

MATERIALS AND METHODS

Experimental design: The study was conducted in a completely randomized design with 3 x 7 factorial arrangements. The first factor was chicken types or lines

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consisted of 3 levels i.e., laying-type cockerels, kampong chickens and arabic chicken. The second factor was age of slaughtering consisted of 7 levels i.e., 4, 5, 6, 7, 8, 9 and 10 weeks. The experiment used 63 DOC laying-type cockerels strain Isa Brown, 63 unsexed DOC kampong chicken and 63 unsexed DOC arabic chicken. Each chicken line was divided into nine groups consisted of 7 chickens. Starting at the age of 4 weeks, one chicken was slaughtered every week to get carcass weight data and the percentage weight of carcass part.

Chicken raising: Chicken raising was conducted in 27 reposed wire cages with 1 x 1 x 1 meter for length x width x height. Each cage contained 7 experimental chickens in the beginning of experiment. Each chicken line consisted of 9 cages. During the study, the experimental chickens were fed with commercial feed produced by PT. Indochem. Nutritional compositions of feed used are presented in Table 1.

Parameter measurement

Body weight: Body weight was obtained by weighing each chicken on weekend. Body weight gain is obtained by reducing body weight in a certain week with chicken's body weight on the first day (DOC).

Feed consumption: Feed consumption was obtained by measuring the feed consumed every week. Weekly feed consumption was calculated by reducing the total amount of feed given during the week with the remaining feed at the end of the week.

Carcass weight and the percentage weight carcass part: Measurements of carcass weight and the percentage weight of carcass part were conducted every week and started at the age of 4 weeks. The measurement was conducted by taking one chicken from each cage randomly and weighed to obtain the live weight. After slaughtering, feathers, head, neck, legs and internal organs were removed to obtain carcass weight. The weight of carcass components (drumstick, thighs, wings, breast and back) were obtained by separating and weighing each part of carcass.

Statistical analysis: The influence of the line and age of chicken on all observed variables were analyzed by using analysis of variance and further test was by the LS-MEANS using the GLM procedures SAS software (2004).

RESULTS AND DISCUSSION

Feed intake, body weight gain and feed efficiency in different chicken lines and ages are presented in Table 2. Line of chicken did not affect feed intake ($p>0.05$), but the increased age of chicken increased feed intake ($p<0.01$) and there was no interaction between the line of chicken and the age on feed intake

Table 1: Nutrient composition of experimental feed

Nutrient	Percentage (%)
Crude protein	20.46
Crude fat	6.75
Crude fiber	2.13
Water	11.19
ASH	6.51
Calcium	0.75
Phosphor	0.63

Analytical Laboratory of Faculty of Mathematic and Science, University of Mataram

Table 2: Feed consumption, body weight gain and feed efficiency of different lines and ages of chickens

	Parameters		
Treatments	Feed consumption (g/bird)	Body weight gain (g/bird)	Feed efficiency (%)
Line (L)			
Laying-type cockerels	1599	533^{a}	0.376
Kampong	1281	389^{b}	0.364
Arabic	1468	382^{b}	0.371
Age (A) (weeks)			
1	59^{a}	29^{a}	0.484^{a}
2	166^{b}	76^{b}	0.466^{a}
3	355^{c}	142^{c}	0.399^{b}
4	588^{ab}	226^{ab}	0.388^{b}
5	1143^{ac}	365^{ac}	0.381^{b}
6	1410^{ba}	458^{ba}	0.350^{ab}
7	1901^{bc}	577^{bc}	0.334^{ab}
8	2357^{ca}	696^{ca}	0.318^{ab}
9	2939^{cb}	847^{cb}	0.305^{ab}
10	3497^{abc}	930^{abc}	0.279^{ab}
SEM	170.739	7.169	0.012
p-value			
Line (L)	0.0565	<0.0001	0.4929
Age (A)	<0.0001	<0.0001	<0.0001
L x A	0.9981	<0.0001	0.8670

$^{a-c}$Means in the sam row without common superscript differ at $p<0.05$

($p>0.05$). The data obtained from this study showed that the three lines of chicken used (laying-type cockerel, kampong chicken and arabic chicken) had quite similar levels of feed intake, ranging from 1281-1598 g/bird/week. The data in Table 2 also showed that feed consumption of the three lines of chicken used in this study increased with the increase of age. Feed intake during the first week of study was 588 g/bird and after 10 weeks of age feed consumption reached 3496 g/bird.

The data in Table 2 also provided information that the line of chicken and its age affect body weight gain ($p<0.01$) and there was an interaction effect between the line of chicken and age on body weight gain ($p<0.01$). The highest body weight gain was found in laying-type cockerel, followed by kampong chicken and arabic chicken, respectively. Laying-type cockerel showed 27.047% higher weight gain as compared to kampong chickens and 28.375% higher as compared with the arabic chicken. The similar study on the growth of laying-type cockerel, kampong chicken and arabic chicken has been reported by Tamzil *et al*. (2013) who found that

Table 3: Carcass weight and the weight carcass part in different lines and ages of chickens

	Parameters					
		Weight of carcass part (%)				
Treatments	Carcass weight (%)	Breast	Thighs	Drumstick	Back	Wings
Lines (L)						
Cockerels	58.65[a]	22.14[a]	17.88[a]	15.50[a]	26.19[a]	15.15[a]
Kampong	62.25[b]	24.08[b]	16.95[b]	14.95[a]	25.41[ab]	14.95[b]
Arabic	61.50[b]	23.35[a]	17.05[b]	14.07[b]	26.72[b]	14.04[ab]
SEM	0.49	0.24	0.30	0.23	0.28	0.21
Age (A) (weeks)						
4	57.54[a]	23.25[a]	17.23[a]	13.85[b]	28.01[c]	15.39[b]
5	59.89[a]	24.14[b]	17.09[a]	14.30[b]	26.87[ab]	15.74[b]
6	61.39[b]	21.32[a]	17.35[a]	13.14[a]	24.56[a]	13.19[a]
7	60.35[a]	22.57[a]	17.22[a]	14.84[b]	26.01[b]	14.54[ab]
8	60.35[a]	22.57[a]	17.22[a]	14.84[b]	26.01[b]	14.54[ab]
9	63.01[b]	24.45[b]	18.24[b]	16.23[ab]	25.90[b]	14.54[ab]
10	63.08[b]	24.04[b]	18.49[b]	16.65[ab]	25.39[a]	15.04[b]
SEM	0.75	0.36	0.45	0.35	0.43	0.32
p-value						
Line (L)	<0.0001	<0.0001	0.0312	<0.0001	0.0056	0.0004
Age (A)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
L x A	0.4510	0.0604	0.1670	0.0708	0.0577	0.3432

[a-c]Means in the sama row without common superscript differ at p<0.05

body weight of laying-type cockerel was greater than that of arabic chicken and kampong chicken.

Comparison of body weight gain of laying-type cockerel, kampong chicken and arabic chicken (Fig. 1) showed that up to 10 weeks of age, body weight of laying-type cockerel was consistently higher than those of kampong chickens and arabic chicken. On the other hand, the weights of kampong chicken and arabic chicken at the age of 9 weeks were relatively similar, but after the age of 10 weeks, the weight of arabic chicken showed a down ward trend. This means that up to 10 weeks of age, laying-type cockerel and kampong chicken were still growing well, however, arabic chicken showed a declining growth. At the age of 10 weeks, the growth of arabic chicken, possibly, has reached inflection point, a point that limits between self-accelerating growth phase and retarding growth phase. Different from the arabic chicken, at the age of 10 weeks, laying-type cockerel and kampong chicken are still in the phase of self-accelerating growth phase. Self-accelerating growth phase is a phase in the growth curve where weight gain occurs as a result of cell proliferation, cell enlargement and collection of substances from the environment surrounding the cells. Retarding growth phase in the growth curve is where the force of growth inhibition coming from closed body system causes limitation of cell growth and also the limitations of resources for growth (Brody, 1945; Pomeroy, 1955). At the age of 10 weeks, body weight of kampong chicken reached 855.654 g/bird, while arabic chicken only reached 814.547 g/bird.

Data from this study provide information that laying-type cockerels had a higher growth rate than that of kampong and arabic chickens. Kampong chickens are Indonesian native chicken that has a slow growth rate (Sulandari *et al*., 2007a). At the age of 12 weeks, kampong chicken can achieve 708 g of body weight but at the age of 20 weeks it can only achieve 1408 g of body weight (Iskandar, 2007). Similarly, the weight of Arabic chicken at the age of 20 weeks only reached 1.2 kg (Tamazil *et al*., 2013). However, in this study the average weight of kampong chickens at the age of 10 weeks reached 895.565 g/bird, lower than body weight of Taiwanese native chicken at the same age. Taiwanese native chicken can reach average 1731 g of body weight (Roan and Hu, 1997). The high body weight obtained in this study could probably due to the source of kampong chicken used was KUB chickens (superior Balitnak kampong chicken) that were selected as laying hens. The selection process affects the uniformity of chicken's body weight resulting in a higher chicken weight. The average body weight of non-selected kampong chickens at the age of 4 weeks was 148 g, while the averages body weights at the age of 12 and 20 weeks were 708 and 1408 g (Creswell and Gunawan, 1982). Body weight of kampong chickens at the age of 12 weeks from selected parent was 860 to 900 g (Iskandar *et al*., 2000), that was higher than the weight of male kampong chicken from non-selected parent, reaching only 713.7 g (Muryanto *et al*., 2002). Body weights of kampong chickens and arabic chicken were much smaller than that of local Tswana which reached 1 kg at the age of 14 weeks (Thutwa *et al*., 2012). Growth performance of kampong and arabic chickens are similar to that of Malawi local chickens fed with commercial feed which can reach average 1 kg at the age of 20 weeks (Safalaoh, 1998). At the age of 10 weeks, the average weight of laying-type cockerel in this study reached 1160 g/bird, which was lower than the result obtained by Murawska *et al*. (2005) who found that the average body weight of laying-type cockerel was 1434 g/bird.

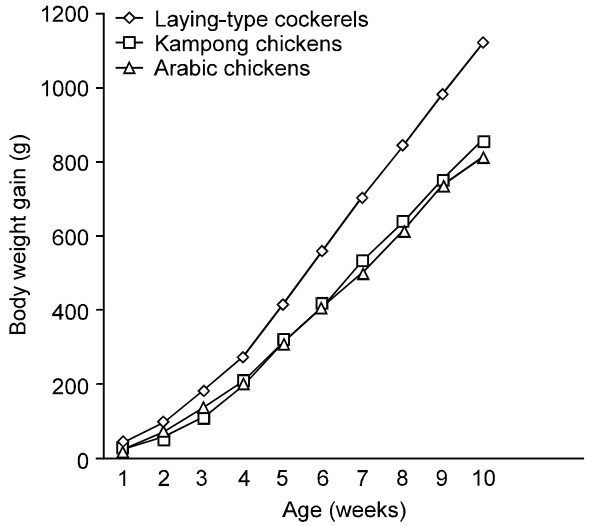

Fig. 1: Average body weight gain of laying type cockerels, kampong chickens and arabic chickens from 1 to 10 weeks of age

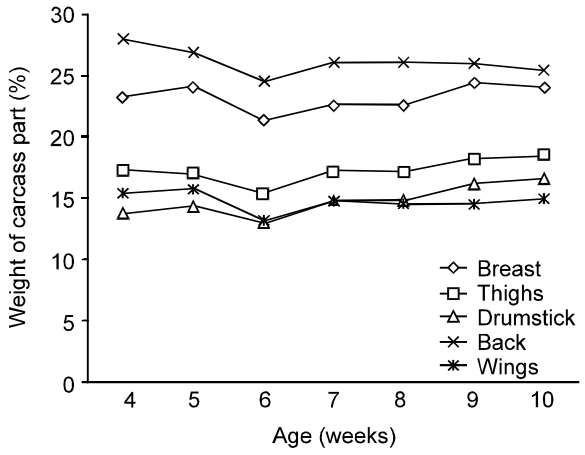

Fig. 2: Percentage weight of carcass part of laying-type cockerels, kampong chickens and arabic chickens from 4-10 weeks age

The three lines of chicken used in this study had similar feed efficiency pattern i.e., feed efficiency decreased with the increased chicken's age. This is a consequence of the growth model which decreases with the increase of age and stop when entering self retarding growth phase when poultries reach puberty (Brody, 1945; Pomeroy, 1955). On the other hand, the amount of feed required increased with the increase of age, thus the feed efficiency decreased with the increase of age.

The effects of chicken line and age on carcass weight and the percentage of carcass part are presented in Table 3. The data showed that the line of chicken significantly affected carcass weight and the percentage weight of carcass part ($p<0.01$). The data showed that the age of the chicken affected carcass weight and the percentage weight of carcass part ($p<0.01$). However there was no interaction effect between the line of chicken and age on carcass weight and the percentage weight of carcass part ($p>0.05$).

The highest carcass weight in this study was found in kampong chicken, followed by arabic chicken and laying-type cockerels, respectively. The low carcass weight found inlaying-type cockerels was due to the laying-type cockerels experienced growth of hair, head, neck and feet that were larger than those of kampong and arabic chickens. The same reason could be the cause of carcass weight of kampong chicken was higher than that of Arabic chicken. The results of this study demonstrate that genetic factors (line of chicken) affect carcass weight. The same results were also experienced by native chickens from various countries as were reported by de Marchi *et al*. (2005), Iqbal *et al*. (2009), de Almeida and Zuber (2010), Daikwo *et al*. (2011), Thutwa *et al*. (2012), Isidahomen *et al*. (2012) and Khalid *et al*. (2012).

The data in Table 3 also provide information that kampong chicken has higher breast weight than arabic and laying-type cockerels. The higher breast weight in kampong chicken as compare to those in arabic and laying-type cockerels is a sign that kampong chicken has a potential to be developed as a meat type (alternative meat producer). Kampong chickens used in this study were KUB chicken which had undergone a selection process for egg production. The selection process affects the uniformity of chicken weight and growth, including the growth of breast meat, resulting in a higher percentage of breast weight when compared to those of arabic and laying-type cockerels.

The data in Table 3 also show that thigh and drumstick (the largest organ meats deposit after chest) in laying-type cockerels relatively grow faster than those in arabic and kampong chickens. It can be concluded that the meat growth in kampong and arabic chickens are more dominant in the breast area, while in the laying-type cockerel the growth of meat is dominant in the thigh and drumstick. According to Murawska *et al*. (2005) who observed the growth of laying-type cockerels up to 18 weeks, the biggest deposits of meat on laying-type cockerels was in the breast and thigh area, but the meat deposit on those parts of laying-type cockerels were not as much as those of on the same part on broiler chickens (Gerken *et al*., 2003). This result implies that raising of laying-type cockerels for meat production is not efficient as compared to broiler chicken (Damme and Ristic, 2003).

The results of this study also showed that the highest back weight was found in arabic chicken, followed by the laying-type cockerels and kampong chicken. On the other hand, the highest weight of the wing was found in laying-type cockerels, followed by arabic and kampong chickens. Therefore, it can be concluded that the

difference in the line of chicken (genetic) affects the back and wing weight percentages.

When the percentage of back weight data in Table 3 and Fig. 2 are observed, it can be seen that the back weight is the biggest component of carcass part, followed by the weight of the breast, thigh, drumstick and the smallest component is the weight of the wings. The back is a component of the carcass part which mainly consisted of bone. Bone is a component of body which grows and matures faster since hatchery (Hafez, 1955). Thus, when poultry is slaughtered, bones percentage is the highest.

The effect of slaughtering age on carcass weight as was presented in Table 3 showed that the increase of age increased the percentage of carcass weight. The increased carcass weight is a reflection of the growing process. During the growing process, one or all the following three processes are occurred i.e., cell proliferation, cell enlargement and incorporation of substances collected from the environment (Brody, 1945). This growth phenomenon also occurs in all animals including poultry, such as Taiwanese native chickens (Roan and Hu, 1997) and Tswana chicken (Thutwa *et al*., 2012).

With the advance of age, the weight of carcass part increase and the increased age increases the weights of breast meat, thigh and drum stick, but reduces the weights of back and wing. The reduction of back and wing weights is caused by the fact that these two parts of chicken body are mainly composed of bones which have the fastest growth and maturity. Thus, at certain age, the growth of bones will be slower while other parts of the body grow continuously. Similar phenomenon happened to Taiwanese native chicken (Roan and Hu, 1997) and Tsawana chicken (Thutwa *et al*., 2012). The weights of head, neck, legs, back and giblets of these chickens decrease with the increase of age and weight, but the weights of the wings, breasts and thighs increase with the increase of age and weight.

The averages of carcass weights of laying-type cockerels, kampong and arabic chickens in this study are 58.65, 62.25 and 61.50%, respectively. These weights are lower than the average of carcass weight of kampong chickens reported by Iskandar (2007) that ranges between 66-72% (average 69%). The low percentage of carcass weight found in this study is caused by the different lines of chicken, slaughtering ages and management applied when raising the chickens. Iskandar (2007) observed the carcass weight of kampong chicken at the age of 12 weeks using kampong chicken feed. In this study, carcass weight was observed on laying-type cockerels, KUB chicken and arabic chicken starting from age 4 to 10 weeks using a commercial broiler feed.

Conclusion: This study concluded that laying-type cockerel, kampong chicken and arabic chicken had the same feed intake and feed efficiency, but had different body weight gains, carcass weights and the percentage weights of carcass part (drumstick, thighs, wings, breast and back). The increase of age affected feed intake, body weight gain, feed efficiency, carcass weight and the percentage weight of carcass part. There was an interaction effect between the line of chicken and age on body weight gain, but there was no interaction on feed intake, feed efficiency, carcass weight and the percentage weight carcass part (drumstick, thighs, wings, breast and back).

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