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PECTORALIS THORACICUS MUSCLE PERFORMANCE OF HYBRID CHICKEN (F1) DERIVED FROM CROSSBREED BETWEEN BROILER AND *PELUNG* (*Gallus gallus gallus*)

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ABSTRACT

This research purpose was to study the phenotype characters of body weight and *pectoralis thoracicus* muscle performance of hybrid chicken (F1) derived from crossbreed between parent stock broiler strain Cobb-500 and *Pelung* (*Gallus gallus gallus*). The chicks were divided into 3 groups and each group consists of 5 days-old chicks (DOC). Group 1 (T1) was used as control involving DOC derived from crossbreed between female and male of broiler Cobb-500 strain. Group 2 (T2) involving DOC derived from crossbreed between female and male *Pelung*, while Group 3 (T3) was DOC derived from crossbreed between female broiler strain Cobb-500 and male *Pelung*. The chicken was grown up to 49 days to evaluate the body weight, the *pectoralis thoracicus* weight, the *pectoralis thoracicus* area, and myofiber area. Data were statistically analyzed using one way Anova. The results showed that the average of body weight in T1; T2; and T3 were 2,170±86.02; 506.2±20.02; and 1,238±68.25 g, respectively (P<0.05). The average of *pectoralis thoracicus* muscle weight in T1; T2; and T3 were 165.04±11.97; 21.26±2.44; and 68.74±1.94 g, respectively (P<0.05). The average of *pectoralis thoracicus* muscle area in T1; T2; and T3 were 97.0±9,7; 61±6,4; and 63,4±1,8 cm^2, respectively (P<0,05). The average of *pectoralis thoracicus* myofiber area in T1; T2; and T3 were 14.72±1.04; 4.66±2.1; and 13.13±1.3 μm^2, respectively (P<0.05). It was concluded that crossbreed between broiler strain Cobb-500 and *Pelung* improved the body weight and *pectoralis thoracicus* muscle performance of hybrid chicken (F1).

Key words: parent stock broiler Cobb-500 strain, *Pelung*, performance of *pectoralis thoracicus*

ABSTRAK

Penelitian ini bertujuan mengetahui berat badan dan performan otot pectoralis thoracicus pada ayam (F1) hibrid hasil persilangan ayam pelung dengan ayam parent stock broiler strain Cobb-500. Ayam dibagi dalam tiga kelompok, masing-masing terdiri atas lima ekor day old chicks (DOC). Kelompok 1 (T1) sebagai kontrol adalah DOC hasil perkawinan antara ayam betina strain Cobb-500 dan jantan strain Cobb-500, kelompok 2 (T2), DOC perkawinan antara ayam betina pelung dan ayam jantan pelung, kelompok 3 (T3) adalah DOC perkawinan antara ayam betina strain Cobb-500 dan ayam jantan pelung. Pengukuran bobot badan, bobot otot, luas area otot, dan luas area miofiber otot pectoralis thoracicus (PT) diperoleh pada hari ke-49 dan dianalisis menggunakan analisis varian (Anava) pola satu arah. Rata-rata bobot badan pada T1; T2; dan T3 masing-masing adalah 2.170±86,02; 506,2±20,02; dan 1.238±68,25 g (P<0,05). Rata-rata bobot otot PT pada T1; T2; dan T3 masing-masing adalah 165,04±11,97; 21,26±2,44; dan 68,74±1,94 g (P<0,05). Rata-rata luas area otot PT pada T1; T2; dan T3 masing-masing adalah 97,0±9,7; 61±6,4; dan 63,4±1,8 cm^2 (P<0,05). Rata-rata luas area miofiber otot PT pada T1; T2; dan T3 masing-masing adalah 14,72±1.04; 4,66±2,1; dan 13,13±1,3 μm^2 (P<0,05). Berdasarkan hasil penelitian ini dapat disimpulkan bahwa hasil persilangan antara ayam broiler strain Cobb-500 dengan ayam pelung dapat meningkatkan berat badan dan performan otot pectoralis thoracicus ayam hibrid (F1).

Kata kunci: ayam parent stock broiler strain Cobb-500, ayam pelung, performan otot pectoralis thoracicus

INTRODUCTION

Local chicken, also known by Indonesian as domestic chicken or *Buras* chicken, is higly favored by people for both its meat and egg. Indonesian people love domestic chicken because its meat is more delicious and tasty than broiler chicken. Another reason is related to chicken feed. People believe feed combined with drugs such as antibiotics, can affect the quality of meat (Agustina, 2013). In 2013, the number of domestic chicken nationwide reached 290.4 million. The population of domestic chicken had increased from previous years (Dirjen Peternakan, 2013). At the same time, the market demand for domestic chicken commodity always increases, for example, in Jabodetabek area, only 5% of the demand of new chicken was fulfilled, or about 280,000 chickens per day (Anonymous, 2013).

One of the local chicken in Indonesia that has potential as broiler is *Pelung* chicken, which has higher body weight than domestic chiken, *Bekisar* chicken, and *Balenggek* chicken. Adult *Pelung* males and females can reach 3.37 kg and 2.52 kg, respectively. *Pelung* chicken have a large size and straight posture, with long neck and sturdy legs. A relatively large body makes the adult *Pelung* males to have the potential as a producer of meat (Iskandar and Susanti, 2007). The large body size of *Pelung* chicken allows for growth improvement of other local chickens, which have smaller body size. Study conducted by Balai Penelitian Ternak Departemen Pertanian to investigate the intensive performance potential showed that chicken *Pelung* can reach 1,100-1,350 gram/chicken at age of 12 weeks. This study indicated that *Pelung* chicken can be utilized for improvement of growth quality (Iskandar, 2006).

The ability of a local broiler had not yet able to keep up with non-local chickens, in which within 35 days can reach 1,500 g/chicken. Local chickens take about 12-16 weeks to reach this weight. The major obstacles in genetic quality improvement of genuine chicken in Indonesia which had potential as broiler among others are unclear crossbreed and minimal identification of the potential broiler. The improvement

of chicken genetic quality could be carried out through crossbreeding process. The results of crossbreeding between chickens male and female conducted by Balai Penelitian Ternak Departemen Pertanian showed at week 12th the body weight of hybrid chicken reached 1,076 g/chicken, which is 20% higher than original chicken body weight (Iskandar, 2006).

Chickens that have potential as broiler, usually refers to the muscle growth. Muscle tissue consists of many myofibers, which are known to be a major component of muscle. The appearance of myofiber in the chicken muscle is related with the acceleration of body weight and chest muscle weight (Scheuermann *et al*., 2004).

MATERIALS AND METHODS

Pelung chiken and broiler chiken Cobb-500 strain reared in a semi-intensive with a ratio of one male chicken to four females. The chickens were fed with medicine, vitamins, standard food in the form of BR type pellets and waters.

The DOC was divided into three groups and each group consists of five male day old chicks (DOC). Group 1 (T1) as control was DOC result of cross breeding between female broiler parent stock (PS) strain Cobb 500 with males broiler chicken strain Cobb -500. Group 2 (T2) was DOC result of cross breeding between female pelung chicken with male *Pelung* chickens. Group 3 (T3) was DOC result of cross breeding between PS female broiler strain Cobb-500 female with male *Pelung* chicken. Chicken body weight was measured when then chicks reach the age of 49 days using manual scales. Then, the chickens were sacrificed to measure the muscle weight, muscle area, and myofiber pectoralis thoracicus (PT) area. The left side of PT muscle was weighed to measure its weight, while the right side was used to measure the area of PT by using ott planimeter. Myofiber area was measured using micrometer software from histology samples of PT muscle which was previously stained with hematoxylin-eosin (Velleman *et al*., 2003).

Data Analysis

The PT muscle weight, total area of PT muscle, and myofiber area were analyzed using one way variance analysis (Anova); continued with LSD-test and Tukey-test at 5% significance level.

RESULTS AND DISCUSSION

Body Weight

The average of chickens body weight after 49 days maintenance were presented in Table 1. The result showed that the mean body weight in T1; T2; and T3 was 2,170±86.02; 506.2±20.02; and 1,238±68.25 g, respectively ($P<0.05$). Weight gain in T1 was significantly different than other groups. It may be due to the potential of broiler chickens as as a meat producers. In broiler, during the growth period from 14-21 days, the activity of trypsin enzyme and other protease enzymes was high, so the effect of the age on amino acid absorption in the intestinal and absorption of lysine amino acids was better in young chickens than older ones. After the chicken is more than three weeks old, the activity of digestive enzymes decreased (Nitsan *et al*., 1991; Zuprizal, 2008).

The average crossbreed chicken weight in T3 was higher than those in T2. These results indicated that crossbreeding inherit the nature of broilers and rapid growth of broiler mothers.

According to Buckle *et al*. (1987), the growth was influenced by two things, intrinsic factors (hormones and genes) and extrinsic factors (temperature, disease, and feed). Genetic factors play a major role in affecting the growth. Chickens have wide genetic variations, indicated by variations of comb (pial), thyroid, and gonads whose development was regulated by the anterior pituitary hormone. Some genes appearred together, for example a single pial shape and the color of white fur of broiler are most likely present along with rapid weight gain. Genes are responsible for abnormal hormonal conditions, such as accumulation of excess fat to increase weight growth in broiler chickens. Research on the rate of weight gain and growth efficiency in pigs suggests that weight gain was influenced by hybrid vigor resulted from a more efficient metabolic system. The vigor hybrid was caused by a non-additive action of the gene. Chicken growth rate was also influenced by body weight at the age of 0-week (Mozdziak *et al*., 2002).

Koutsos (2012) stated that the type, chemical composition, and feed consumption greatly affect growth. Feed was an extrinsic factor that had the greatest effect on growth (Mozdziak *et al*., 2002). According to Koutsos (2012), the effect of shortage of feed is enormous, but is determined by the age at the time of shortage of feed, the duration of the shortage of feed, and the kind of food shortage (energy, vitamins and other nutrient deficiencies). The most appropriate feed is a feed with a similar chemical composition with thes carcass, while the feed quantity will affect the sustainability of its growth. High protein feed can accelerate growth, but the increase in protein quantity is not always linear with the growth rate.

According to Heuck *et al*. (2009), hormones that affect growth could be divided into two groups, namely; (1) anabolic groups and (2) catabolic groups. Somatotropic hormone (STH) or somatotropin or growth hormone (GH), testosterone, and thyroxine are anabolic hormones, while estrogen is catabolic hormone. Hormones that have a direct influence on growth are somatropin, thyroxine, androgen, estrogen, and glucocorticoids (GC) which affect the growth of body mass, including bone growth and nitrogen metabolism. Furthermore, Vasilatos *et al*. (2000) stated that the anterior pituitary gland located within the skull at the base of the brain, secretes hormones that closely related to individual growth namely somatotropin (STH) or GH. GH is a protein secreted by asidophillic pituitary cells which affect amino acid metabolism. This effect is seen in the growth of young animals. GH

Table 1. Performances of *pectoralis thoracicus* (PT) muscles in each crossing group in age of 49 days

Parameters	Group		
	T1 (n= 5)	T2 (n= 5)	T3 (n= 5)
Body weight (g)	2,170±86.02[c]	506.2±20.02[a]	1,238±68.25[b]
PT muscle weight (g)	165.04±11.97[c]	21.26±2.44[a]	68.74±1.94[b]
PT muscle surface area (cm^2)	97.0±9.7[b]	61±6.4[a]	63.4±1.8[a]
PT muscle myofibre surface area (μm^2)	14.72±1.04[b]	4.66±2.1[a]	13.13±1.3[b]

[a,ab,b] Different superscript in the same row shows a significant difference (P<0.05), (T1= ♀ broiler chicken X ♂ broiler chicken; T2= ♀ *Pelung* chicken X ♂ *Pelung* chicken; T3= ♀ broiler chicken X ♂ *Pelung* chicken)

decreases the amount of fat stored in the body and affects carbohydrate metabolism.

In this study, the PT muscle weight and PT muscle area on T1 showed a marked improvement on the 49th day of treatment compared with T2 and T3. Velleman *et al*. (2014) reported that muscle growth after the chicken hatched, relies on the addition of new nuclei of the myoblast into myofiber formed during the embryonic period by myoblast hyperplasia. Early age chickens have active satellites cell which are responsible for nucleic accumulation in the myofiber, and also nutritional factors have an effect on these cells and contribute to myofiber size and proportion of broiler muscle (Mozdziak *et al*., 2002; Kornasio *et al*., 2011). In the early life of the chicken, nutrients would affect the activity of mitotic cell cells in the muscle, which clearly affects muscle size due to the fusion of the myonuclear growth with the satellite cell nuclei which are later required for myofiber hypertrophy (Mozdziak *et al*., 2002; Zielinska *et al*., 2010). Another possibility concerning the size of cells in young chickens is the effect of nutritional factors on deoxyribonucleic acid (DNA) units, increasing number of DNA units which then fuse with satellite cells, and will be the major determinant on muscle size (Mozdziak *et al*., 2002). The significant differences in PT muscle weight among broiler, *Pelung*, and crossbreeding between female broiler and male *Pelung* indicate the genetic influence on muscle growth (Burke and Henry, 1997; Scheuermann *et al*., 2004).

CONCLUSSION

This study concluded that crossbreeding between broiler strains Cobb-500 with *Pelung* chicken improved the body weight and *pectoralis thoracicus* performance of hybrid chicken (F1).

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