

Inheritance and Comparison of Phenotypic Characters from Hybrid Chicken GK-Bro (*Gallus gallus* Linnaeus, 1758)

PUTU AYU DAMAYANTI¹, BUDI SETIADI DARYONO^{1*}, I WAYAN SWARAUTAMA MAHARDHIKA¹

¹Laboratory of Genetics and Breeding, Faculty of Biology, Universitas Gadjah Mada
Jl. Teknik Selatan, Sekip Utara, Sleman, Yogyakarta, Indonesia. 55281

*Email: bs_daryono@mail.ugm.ac.id

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ABSTRACT

GK-Bro (*Gallus gallus* Linnaeus, 1758) is a hybrid chicken from crossing between ♀ F2 Broiler ♂ F2 Golden Kamper that have variation of phenotypic character. To meet the market's demand, GK-Bro must have prime phenotypic character in both quantity and quality. This research aims to examine the phenotype character that occur in GK-Bro by the character of feet morphometry, crest's shape, feather's color, and feet' color. The parental chicken is crossed in Innovation and Agriculture Centre of Universitas Gadjah Mada (Indonesia) and produce 11 chickens with five males and six females filial. The filial are maintained intensively and qualitative data were observed at the end of seven weeks, classified based on the percentage of the phenotypic class. Quantitative characters that observed were tibia and femur length after seven weeks, using control pelung, broiler and F1 broiler. Quantitative data showed that the average length of the tibia and femur of GK-Bro is lower when compared to the control but the ratio of feet morphometry is closer to pelung. Qualitative data classified crest form in one class, feather's color in 4 classes and feet' color in 3 class.

Keywords: characterization; chicken; morphometric; Indonesia

INTRODUCTION

Indonesia is a developed country and one of the national food resources come from chicken farming. Indonesia has local chicken species with unique phenotypic characteristics that are distributed in various regions as result from domestication of red jungle chickens, chickens from China and Europe (Ulfah *et al.*, 2015; Nataamijaya, 2005; Maw *et al.*, 2012; Setianto *et al.*, 2017). There are 31 local chicken strains with distinctive appearance characteristics (Hidayat & Asmarasari, 2015; Nataamijaya, 2000), and increased to 34 in 2016 (Henuk & Bakti, 2016). To maximize livestock production, genetic breeding methods are used by crossing different breeds. The proportion of the body is one of the selling values of chicken livestock. Chicken that has a sturdy posture will be preferred from chicken with weak and unstable postures. The feet morphometry were consist of tibia and femur length. The length of femur and tibia will affect the selling value in the commercial industry

(Mir *et al.*, 2017; Applegate & Lilburn, 2002; Salaam *et al.*, 2016).

The size of the femur and tibia are parameters determined by genetics and the environment. Qualitative characters were characters that can be seen by the eye, not have quantitative values, and can be classified into categories. Some qualitative characters that can be observed were crest's form, feather's color and feet' color (shank). Broiler is a popular strain hence of their fast growth rate and can be harvested at the age of 5 weeks (Dharmawan *et al.*, 2015).

Broiler has short postures, white feathers, and weights that cause these chickens to not move quickly. To improve the proportions, Broiler was cross with pelung chicken. Pelung chicken is a native chicken that has a high and sturdy posture and has great potential for broilers because roosters weigh ± 3.5 kg and hens reach ± 2.5 kg at the age of 52 weeks (Hidayat *et al.*, 2016). Since 2006 the Laboratory of Genetic and Breeding, Faculty of Biology has developed a breeding program to

get chickens with postures such as pelung chickens and have high productivity such as broiler chickens. In the study, it has succeeded in developing an F1 Broiler which weighs 1100-1500 grams at the age of seven weeks (Mahardhika & Daryono, 2019). Kampung Super (Kamper) is a hybrid from cross between male Pelung chickens and female Layer chicken (Puspita *et al.*, 2017). In 2013-2014, F1 Kamper successfully developed with weights reaching 911-1100 grams at the age of seven weeks (Lesmana, 2016). F1 Kamper has high productivity of egg and meat, but the results of these crosses are still heterozygous with filial's feather range from plain white, brown-white, brown-blackly, black-blazing, to plain black color. The highest productivity filial is golden brown feather. This selective breeding chicken is called Golden Kamper (GK) which is made by broods for subsequent crosses (Habibah, 2018). This paper will study the quantitative and qualitative characters inherited by filial.

MATERIALS AND METHODS

This research was conducted at Agriculture Centre of Universitas Gadjah Mada, Kalitirto, Yogyakarta. The parental used were ♀ F2 Broiler ♂ F2 Golden Kamper. Materials used are semi-analytic scales KrisChef EK9350H, DOC (Day Old Chicken) bamboo cage, 15-watt bulb, place for feed and water, camera CANON EOS 200D, Medline, egg tray, egg incubator, tissue, parental cage K.13 Gama Ayam and egg stimulant MEDION, Vitamin VITACHICK and dietary feed BR I for chick up to seven weeks and AD II feed for chickens over seven weeks old.

Parental Preparation. Parental chicken that has high reproductivity was chosen and the cages for breeding were prepared. The parental must be healthy and active in producing eggs and have to familiarize each other. The parental

maintained by giving food and water every day and mix egg stimulants in the water two times a week. The parental consist of one male and one female parental.

Egg Collection and Incubation. If the parental start producing an egg, the egg must be collected and incubated for twenty-one days until hatching. The average egg produced is 3-4 eggs per day.

Maintenance. DOC in the first week is friable so it has to be placed in a warm cage with five-watt yellow lamp and enough water and food. Once a week the DOC is supplied vitamin to optimize the growth. DOC that survived through this study consist of eleven chicken.

Phenotype Observation and Measurement. The measurement of femur and tibia was done every week and observation of qualitative trait-like crest form, feather color and feet color are done in the end of seven weeks and data were analyzed by Microsoft Excel 2013.

RESULT AND DISCUSSION

Qualitative phenotype characters of filial chicken were observed after seven weeks or 49 days. This observation was done because seven weeks is a representative age for observing characteristics, both qualitative and quantitative before chickens enter the reproductive period. Qualitative characters are traits that cannot be measured but can be classified into different phenotypic categories. The qualitative characters observed included the shape of the crest, feet color and feather (Table 1). In contrast to quantitative polygenic characters, qualitative characters are under the control of one or more genes, with little modification of environmental factors that can obscure the effects of genes (Ben-Zaken *et al.*, 2019; Lobo, 2008; Cahill & Provance, 2002).

Table 1. Qualitative character of GK-Bro

Character	Classification	Percentage (%)
Crest shape	Single	100
Feet's color	White	54.55
	Yellow	36.36
	Black	9.09
Feather's color	Black-brown	9.09
	White-black	27.3

Brown-white	36.4
White	27.3

Qualitative character is one of the characters that show chicken productivity besides its morphometry. This character is inherited from genetic recombination of male parent and female parent. From 11 chickens, all had a single crest shape, and six chickens had white feet, four chickens had yellow feet color and one chicken had a blackish green color. The purpose of crossing chickens is to get filial that is close to the character of native chickens so that the color of the chicken feet that aimed is yellow. White feet can still be accepted on the market while the blackish-green color is not preferred in Indonesia. Black and green feet are preferred in Thailand. The color of feathers in

11 chickens was divided into four phenotypic classes which can be observed, namely the brown-black color consisting of one chicken, white-black color consisting of three chickens, white-brown color consisting of four chickens, and white consisting of three chickens. White-brown is white which has a brown spread on the chest, neck and wings. White-black is white with a variety of black colors, while the brown-black color is a golden brown color combination with black variations, which can be inherited from black pelung and golden kamper. The inheritance of feather color can be observed in Figure 1.

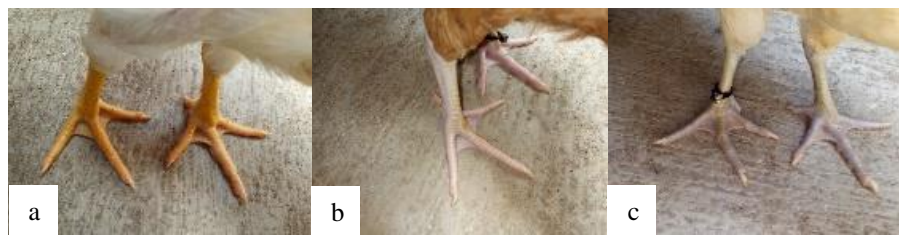


Figure 1. Feet color classification: a. Yellow; b. White; c. Black



Figure 2. Feather's color classification: a. Black-brown; b. White-black; c. White-brown; d. White

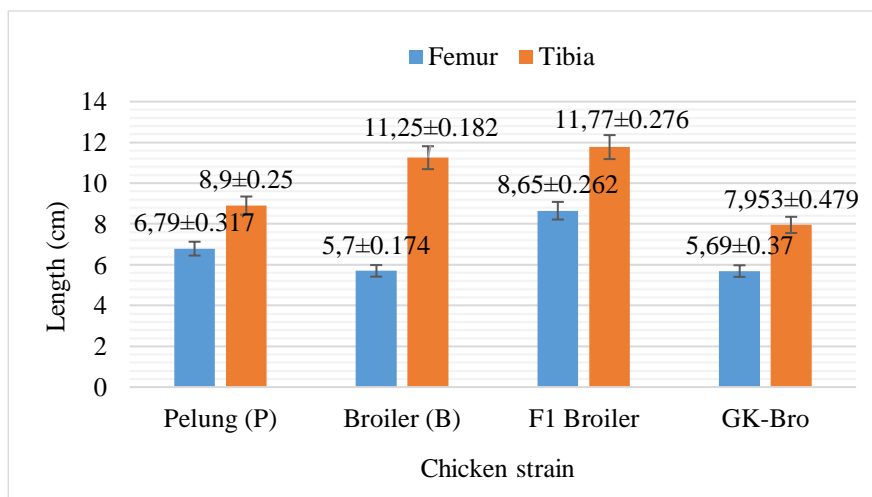


Figure 3. Comparison of tibia and femur length between GK-Bro with control

Inheritance of feather color is a character influenced by an on-off mechanism on gene expression (Chang *et al.*, 2010; Li *et al.*, 2012; Minvielle *et al.*, 2002; McGraw *et al.*, 2005). Genes carrying the properties of white feathers in broilers have become heterozygous with repeated marriages thus the offspring of the crossing of Golden Kamper no longer have

dominant white feathers, but feathers with brown color variations as in their parents Golden Camphor. In addition, the black color derived from pelung is still evident in some filials. Feather expression is an expression controlled by polygenes and the environment (Moiseyeva *et al.*, 2003; Wiebe & Bortolotti, 2001).

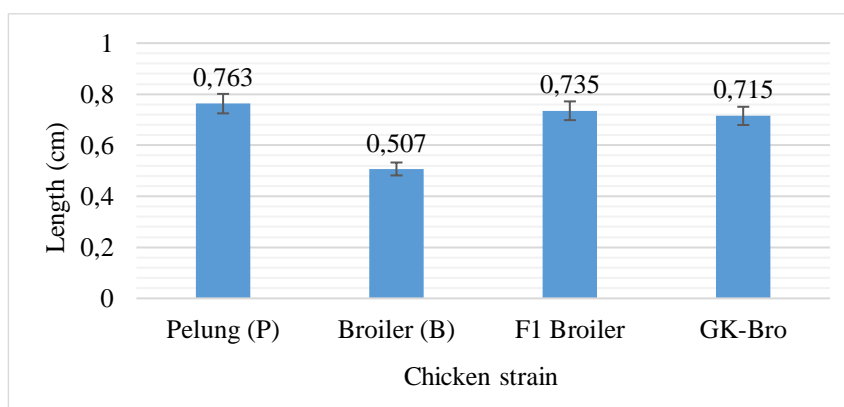


Figure 4. Ratio comparison of tibia and femur length between GK-Bro with control

Control data is the length of the femur and tibia of pelung chicken, broiler chicken, and F₁ broiler chicken (Figure 3). When compared, it can be seen that the femur and tibia ratio in GK-Bro is closer to the femur and tibia ratio in Pelung and F₁ broiler control (Figure 4). Pelung control has femur length (6.79 ± 0.317 mm) and tibia (8.9 ± 0.25 mm), broiler control has femur length (5.7 ± 0.174 mm) and tibia (11.25 ± 0.182 mm), while F₁ broiler control has femur length (8.65 ± 0.262 mm) and tibia (11.77 ± 0.276 mm). GK-Bro having pelung as parental from both sides, thus this crossing gives rise to the morphometric ratio of the foot which is closer to the pelung than the broiler.

Its feet size is much shorter than F₁ broilers because in general filial results of in-breeding crosses (F₂, F₃, etc.) have smaller sizes along with the level of the crossing. Such crosses can give rise to dwarf chickens. This can occur because the expression of genes that arise with inbreeding marriages previously leaves recessive genes that are expressed in subsequent offspring (Visscher *et al.*, 2008; Kristensen *et al.*, 2011; Cassell, 2007; Charlesworth & Willis, 2009). The hen used is F₂ golden camphor and F₂ broiler which is the result of marriage inbreeding from the first filial.

CONCLUSION

The ratio of tibia and femur in GK-Bro chickens tends to inherit pelung characters as parental, but the average length is shorter than F₁ broiler and pelung, GK-Bro chicken has low productivity to consumption purpose. The qualitative character of GK-Bro inherits its parental character because of the activity of polygene. Broiler crossing with Golden Kamper succeeded in reducing the expression of dominant white genes in filial chicken feathers, resulting in four classes of feather phenotypes consisting of brown-black, white black, brown-white and white. Shank color classified into three phenotypic class which is white, yellow and blackish, while the phenotype forms a single cockscomb for all filial chicken populations.

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