Phenotype characteristics of Gaga chicken from Sidrap regency, South Sulawesi

S R A Bugiwati, A Syakir and M I A Dagong

Department of Animal Production, Faculty of Animal Science, Universitas Hasanuddin, Jl. Perintis Kemerdekaan Km.10, Tamalanrea, Makassar 90245, South Sulawesi, Indonesia

E-mail: srirachmaab@unhas.ac.id

Abstract. This study aims to determine the qualitative characteristics of Gaga chickens in Baranti and Pancarijang District, Sidrap Regency. A total of 170 adult Gaga chickens (115 male and 55 female) were used as samples, which were taken by purposive sampling. Qualitative traits observed were feather color, feather color pattern, feather flicker, shank color, comb shape, lobe and eye color. Data were then tabulated based on sex and analyzed statistically descriptive. The results showed that the qualitative trait phenotypes in males and females were dominated by the color feathers in the color category (ii) and recessive in the white color category (I_). The qualitative traits of the male Gaga chicken feather pattern are predominantly wild feather patterns (e+), whereas in females are dominated by black feather patterns (E_). The shape of the single comb and red lobe color is dominant in the Gaga chicken found in Baranti and Pancarijang. While eye color and shank color have phenotypic frequencies that are still very diverse.

1. Introduction

Local chickens in Indonesia for generations have been raised by the community, generally those found in the countryside either as pets, decorating the yard, animals, rituals, as well as family savings. In the province of South Sulawesi, there are local chickens that have a unique crowing character, namely the sound of the end of the crowing like the sound of a human laugh known as the chicken Gaga [1].

Chicken Gaga is included in the protected poultry category (Minister of Agriculture Decree Number: 2920 / Kpts / OT.140 / 6/2011) and is one of the most potential domestic poultry in the chicken business in Indonesia because it has a unique crowing character and is included in germplasm originating from South Sulawesi, Indonesia [2].

Gaga chicken in its natural habitat, especially in Baranti District, Sidenreng Rappang Regency, South Sulawesi Province and its surroundings, is maintained by the community for generations. Physically, the body shape of Gaga's chicken is pleasing to the eye and the color of its feathers is also attractive. Although in plain view is almost the same as Kampung chicken but the uniqueness of the crowing of the chicken is what attracts the attention of ornamental chicken fans to maintain it. Various voice contests of Gaga's cock crowing began to bloom in various regions with prizes reaching tens of millions of rupiah. This causes the chicken Gaga has a high selling price.

The availability of scientific information about the benchmark characteristics of qualitative traits of Gaga chickens is currently very limited so it is still based on references from the qualitative traits of Kampung chickens in general. Whereas genetic information, qualitative and quantitative traits are
needed as a reference to improve the genetic quality of Gaga chickens and assist in the preservation process for their sustainable use. Limited scientific information about chicken Gaga makes chicken Gaga one of the rare local chicken species that needs to be explored. Increasing productivity is not only by improving maintenance management, but it is also necessary to improve genetic quality by maintaining the characteristics of the Gaga chicken.

Based on the above conditions, efforts should be made to preserve the Gaga chicken so that it does not become extinct. Efforts to preserve Gaga chickens require a study of the characteristics of the qualitative traits of the chickens to assist the breeding program because identification of qualitative traits is very important to distinguish Gaga chickens from other local chickens. The purpose of this study was to obtain information on the qualitative characteristics of Gaga chickens. One obstacle to the effort to preserve the type of crowing chicken like Gaga chicken is the lack of information about the qualitative nature of the chicken so that it is still difficult to compare Gaga chickens with other local chickens. This study is expected to be an additional information for the preservation of Gaga chicken as one of Indonesia's animal genetic resources.

2. Methods
This research was carried out in Baranti and Pancarijang districts, Sidrap Regency. The location was chosen because the Sidrap area is the center of the largest population of Gaga chickens and is the origin area of Gaga chickens. The material used in this study were 115 male Gaga chickens and 55 female Gaga chickens aged at least 1 year. The data collection method uses a survey method by observing and observing directly on the Gaga chicken farms in Baranti and Pancarijang Districts in Sidrap Regency, South Sulawesi Province. The sampling method used was purposive sampling which is a non-random sampling data collection technique in which the researcher determines the sampling by specifying specific characteristics that fit the purpose of the study so that it is able to answer the research problem.

The Gaga chicken used is owned by the people's farms which are located in these two sub-districts. Data is collected by observing and recording various qualitative characteristics of male and female Gaga chickens, taking pictures of body parts (head, back, legs, and whole body) and the results obtained are presented in tabular form.

2.1. Observed variables

Determination of feather color, feather pattern, feather flicker, shank color and comb shape using guidelines [3] and for eye and lobe color as the variables observed in this study using guidelines [4]. The basis for determining the qualitative characteristics of variables is as follows:

2.1.1. Feather color. Divided into white feather color (if the entire surface of the chicken feather is white) and colored (if any color other than white is found on the surface of the feathers all over the chicken's body)

2.1.2. Color pattern. Divided into columbian color pattern (generally brown and limited by black on the neck, wings and tail), wild color pattern (if found in black on the chest and ventral).

2.1.3. Flickering of feather colors. Divided into flickering silvery feathers (shiny white color on the neck and head feathers, found in chickens that have white feathers, striated black and white), flickering golden feather colors (golden yellow on the neck and head feathers, found in chickens that have black, brown, striated black and brown feathers).

2.1.4. Shank color. Divided into black / gray, white, and yellow shank.
2.1.5. The shape of the comb. Divided into walnut's comb (if found a three-piece comb in chicken), single comb shape (if a single or single combed comb is found on the chicken).

2.1.6. The color of the lobe. Divided into red, white, and the combination of red and white with the dominant color red.

2.1.7. Eye color can. Divided into orange, brown and yellow eye colors.

2.2. Data analysis

Research data were tabulated based on sex. All observed variables (qualitative traits) are calculated as relative frequency values (percentages) and presented descriptively. The relative frequency of qualitative traits is calculated based on the number of phenotypes that appear divided by the number of all individual chickens multiplied by 100% [5].

The formula used to calculate the relative frequency is as follows:

\[
\text{Frel} = \frac{\sum A}{n} \times 100\%
\]

Note :
- Frel = Relative frequencies
- A = Number of observed traits
- n = Number of observed samples

3. Results and discussion

3.1. Characteristics of Gaga chicken qualitative traits

The phenotype of male and female Gaga chickens in Baranti and Pancarijang districts, Sidrap regency, South Sulawesi Province in general is the same, there are variations in shank color and eye color. Gaga chicken in the districts of Baranti and Pancarijang have phenotypes outside the criteria of [3], namely the feather pattern (black) and the shape of the comb (rose). Characteristics and phenotypic percentages of Gaga chickens in Baranti and Pancarijang districts, Sidrap regency are presented in table 1.

| Characteristics | Baranti | Pancarijang |
|-----------------|---------|-------------|
| Phenotype (%)   | Male (n=65) | Female (n=30) | Male (n=50) | Female (n=25) |
| Phenotype (%)   | Male (n=65) | Female (n=30) | Male (n=50) | Female (n=25) |
| Feather color   | White (I_ ) | 6.15 | 23.34 | 6.00 | 16.00 |
|                 | Colored (ii) | 93.85 | 76.66 | 94.00 | 84.00 |
| Color pattern   | Black (E_ ) | 32.31 | 83.34 | 32.00 | 80.00 |
|                 | Wild (e+)  | 67.69 | 16.66 | 68.00 | 20.00 |
|                 | Columbian (ee) | - | - | - | - |
| Feather flickers| Silver (S_ ) | 36.93 | 20.00 | 22.00 | 40.00 |
|                 | Gold (ss) | 63.07 | 80.00 | 78.00 | 60.00 |
| Shank color     | White (Id) | 29.23 | 40.00 | 30.00 | 28.00 |
|                 | Yellow | 53.84 | 33.34 | 28.00 | 36.00 |
|                 | Black/Grey (id) | 16.93 | 26.66 | 42.00 | 36.00 |
| Comb shape      | Walnut | 6.15 | 26.66 | 6.00 | 72.00 |
|                 | Single | 86.15 | 60.00 | 86.00 | 28.00 |
|                 | Rose | 7.70 | 13.34 | 8.00 | - |
| Lobe color      | Red | 90.76 | 70.00 | 82.00 | 92.00 |
3.2. Feather color
The color of the feathers in the color category dominates the color of the feathers of male and female Gaga chickens in the Baranti and Pancarjiang districts, and only a few Gaga chickens with white feathers color. In both districts, the proportion of color in the feathers of the male Gaga chicken color category is higher than that of female Gaga chickens. In this study, color combinations of feather color in male and female chickens were found, namely black, white-black, brown and black-brown, with several other feather color combinations found in other strains of chickens, especially in roosters. The combination of the feather color is also found in other local chickens, so that it cannot be used as a characteristic or identity of the Gaga chicken.

The variety of feathers color in Gaga chickens is influenced by the work of gen (i) which triggers melanin pigment production. Melanin pigments are divided into two types namely eumelanin which forms black and blue in feathers and pheomelanin which forms red-brown, salmon, and dark yellow [6]. The nature of white feathers is controlled by a gene I (inhibitor) which in a heterozygous (Ii) state reacts to a complete dominant which is indicated by the presence of spots and black lines on the chicken feathers as adults. Whereas in a homozygous state it inhibits the production of black pigment and reduces red pigment in feather [3]. The dominant white feather color (I_) was also found in local chicken strains such as Pelung and Tolaki chickens with a small percentage [7,8]. This condition illustrates that the white feather color in Gaga chickens is recessive compared to other local chickens.

3.3. Color pattern
Male and female Gaga chicken feather patterns found in Baranti and Pancarjiang districts are black (E_), and wild (e+) patterns. While the Colombian feather pattern was not found. This is probably due to the lack of efforts by local breeders to cross between Gaga chickens and other local chickens that have colombian feather patterns, so that the potential emergence of these feather patterns has not yet been seen. In this study the proportion of the appearance of wild feather patterns (e+) in male Gaga chickens in Baranti and Pancarjiang districts was more dominant than black feather patterns, whereas in female Gaga chickens were dominated by black feather patterns (E_). The high frequency of wild feather patterns in male Gaga chickens and black feather patterns in females is suspected because Gaga chickens still have a genetic distance that is close to the Red Jungle Fowl (*Gallus gallus gallus*), where the characteristic feather colors typical for males are wild type and for brown striped black female. This is in accordance with the opinion [9] and [10] that Kampung chickens in Indonesia have a closer genetic distance to Red Jungle Fowl (*Gallus gallus gallus*) and Javanese Red Jungle Fowl (*Gallus gallus javanicus*) compared to Green Jungle Fowl (*Gallus varius*).

Similar results were reported by [11] in Kampung chickens, that the phenotype of wild feather patterns was dominant for male chickens (38%) and black feather patterns were dominant in female (50%). Different results reported by [8], where were phenotypic patterns of local male and female chicken feathers Tolaki and Pelung, having black (E_), wild (e+) and colombian (ee) feather patterns. This phenotype difference indicates that among local chickens also have genetically different strains. Warwick [12] states that differences in qualitative traits are almost entirely determined by genetic differences, whereas environmental differences have little or no influence, so variations in qualitative traits are also genetic variations.

3.4. Feather flickers
The proportion of phenotypes in the flickering of male and female Gaga chicken feathers found in Baranti and Pancarjiang were dominated by golden feather flips. However, it is different in female
Gaga chickens in Pancarijang district, which were relatively balanced between the proportion of golden and silvery feather flips. Silvery feather (S) and golden feather (s) genes are sex linked genes[13].

Silvery feather flips are usually found in red, green, brown, black and white feathers, while gold feather flips are found on feathers which have a golden yellow feather color[7]. Flickering fluffs are genetically adrift so that males are found in homozygous or heterozygous conditions, whereas in females in hemizygotic conditions[13]. But the flickering of the fur is not so obvious in the color of the fur with a more diverse color combination. Indications of high homozygosity (SS) feather flipping properties in the Gaga chicken population are strongly influenced by the mating system. Warwick[12] states that inbreeding can result in increased homozygosity and decreased heterozygosity.

3.5. Shank color
The results showed the colors of male and female Gaga chicken shanks in Baranti and Pancarijang districts were white, yellow and black / gray but with varying phenotypic frequencies. The frequency of yellow shank color on Baranti roosters is highest in white (Id) and lowest in black / grey (id), whereas in females is dominated by white shank color (Id) and recessive in yellow and black / gray (id) shank. Unlike in male Gaga chickens in Pancarijang, which are dominated by the color of black shank (id), whereas in female Gaga chickens tend to be shank yellow or black / grey (id).

Shank color differences are caused by the presence of carotenoid pigments in the epidermis and the absence of melanin pigments in the epidermis and dermis[14]. However, if carotenoid and melanin pigments are not present, the shank will be white[15].

The color of the yellow shank in chicken Gaga is probably caused by a combination of different pigments on the top and bottom layers of the skin. This is in accordance with statement[3] which states that the yellow color of the shank is due to the presence of lipochrome fat or pigment in the epidermal layer.

3.6. Comb shape
The phenotype of the comb shape found in Baranti and Pancarijang districts were walnut, single and rose. Male and female Gaga chickens in Baranti and Pancarijang districts were predominated by single comb, except for the female Gaga chickens in the Pancarijang district more dominated by the walnut's comb. Indonesian local chickens that already have uniformity in the shape of a comb, were Pelung, Black Kedu and White Kedu chickens. [7] reported that the Pelung chicken's 100% comb was single comb and has become one of its standardized qualitative trait. While [16] states that Black Kedu and White Kedu chickens have the same form of single comb, with a frequency of 100%. The similarity in the proportion of uniformity in the shape of Gaga's chicken comb indicates the possibility that the Gaga chicken was in the same family with the local chicken.

The shape of the Walnut's comb is more dominant in female Gaga chickens in Baranti and Pancarijang districts, while the single comb and rose forms were more often found in male Gaga chickens in Baranti and Pancarijang districts. The proportion of Gaga chicken combs in this study is somewhat different from that of native chickens, as reported [17] that the shape of the comb rooster consists of 29% pea, single 21%, walnut 12% and rose 38%. This is supported by the statement [18], stating that Kampung chicken has a higher level of diversity compared to other local chickens.

3.7. Lobe color
The ear lobe is thick flesh located at the bottom of the ear. According to [19], the lobe color varies according to each chicken breed. The colors of the Gaga chicken lobes found in Baranti and Pancarijang districts were red, red-white and white lobes. A higher proportion of the appearance of red in the lobe was found in male and female Gaga chickens in Baranti and Pancarijang districts. In both districts, it was seen that the lobes of white and red and white had a lower proportion found in both sexes. Crawford [20], states that most chicken breeds have red lobes. In the Red Jungle fowl found a mixture of red and white lobes with red color was predominant.
3.8. Eye color
The color of the eyes of male and female Gaga chickens found in Baranti and Pancarajang districts were orange, brown and yellow. In this study the color phenotype frequencies of Gaga chicken eyes were found to be very diverse. Male Gaga chicken in Baranti district is dominated by yellow eye color while female chicken was dominated by orange eye color. While male and female Gaga chickens in Pancarajang were relatively uniform.

Real eye color can not be ascertained until adulthood when the melanin and carotene pigments were fully expressed. The results of crossing between black-feathered brown-eyed chicken breeds with bay-eye chicken breeds with black feather color constraints apparently can determine the relationship between eye color containing melanin with dark feather colors [21].

4. Conclusion
Heterogeneity of qualitative traits of male and female Gaga chickens is still relatively high. The color of the feathers of male and female Gaga chickens is dominated by the colored feathers category (ii) and recessive in the white category (I_). The color pattern of the chicken feathers of the male Gaga is dominated by wild feather patterns while the female is black. Single comb shape and lobe color are the highest phenotypic proportions in Gaga chicken. The proportion of shank color phenotypes and eye color in Gaga chickens still varies.

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