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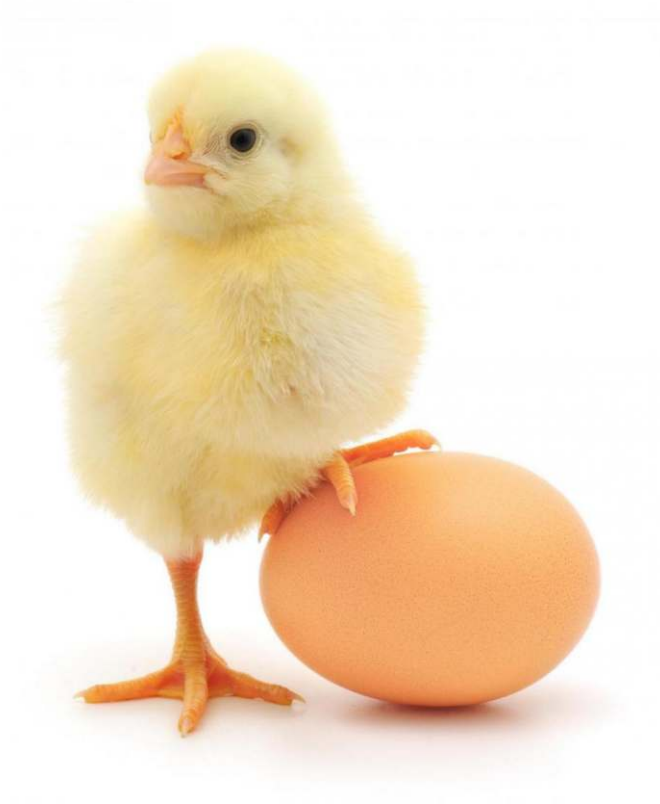

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Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorijps@gmail.com

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Research Article
Phenotypic Characterization of Indonesian Native Chicken with Different Combs

Dyah Maharani, Wihandoyo, Galuh Adi Insani, Laurentia Adinda and Dwi Nur Happy Hariyono

Faculty of Animal Science, Universitas Gadjah Mada, Jl. Fauna 3, Bulaksumur, Yogyakarta 55281, Indonesia

Abstract

Objective: The study was carried out to characterize the qualitative morphological traits of Indonesian native chickens. **Materials and Methods:** Forty adult male chickens made up of 4 chicken groups based on different comb types (single, pea, rose and walnut) were visually appraised for the qualitative traits. Data on qualitative traits were analyzed using descriptive statistics and compared as percentages. **Results:** In single group, the majority of chickens have dark yellow beak (40%), red-brown crown (50%) and neck feather (50%), black for the feather of chest (50%), abdomen (50%), back (60%), primary (60%) and secondary wings (90%) and tail (40%). In Pea group, the majority of chickens possessed light yellow beak (50%), red-brown crown (40%) and neck feather (40%), white-brown chest feather (40%), black for the feather of abdomen (40%) and back (30%) and black-green tail (40%). In Rose group, most of chickens possessed light-yellow beak (40%), red crown (40%), yellow neck feather (50%), red for the feather of chest (40%) and abdomen (40%), black back feather (60%) and black-white tail (60%). In Walnut group, the majority of chickens have pale yellow beak (50%), red-brown crown (80%) and neck feather (60%), black for the feather of chest (40%), abdomen (40%) and back (30%) and black-white tail (40%). Dark eye, black primary and secondary wings, black thigh feather, light yellow membrane shank and yellow shank were predominant in all chicken groups. **Conclusion:** Indonesian native chickens possess a considerable phenotypic diversity that could be important for the genetic improvement through systematic breeding strategies.

Key words: Combs, genetic improvement, local chicken, morphological characteristics, phenotypic characterization, plumage color, qualitative traits

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Corresponding Author: Dyah Maharani, Faculty of Animal Science, Universitas Gadjah Mada, Yogyakarta 55281, Indonesia
Tel: +62-274-513363 Fax: +62-274-521578

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Food from poultry products has a vital role to the national food security in Indonesia and illustrates a significant contribution to the animal protein supply. National consumption of animal protein from the livestock products increases in average of 37.36% annually during the period between 1990 and 2006[1]. Chicken meat is highly consumed with broiler as the most contribution to the chicken meat.

Poultry production in Indonesia has been divided into traditional and commercial sub-sectors. The traditional sub-sector made up of many indigenous chicken ecotypes. The native chickens are commonly reared under traditional scavenging system by many villagers, without high inputs for feeding, housing and health care. The poultry keepers are more interested on broiler rearing than native chickens, since broiler is easier to be reared with faster harvest time compared to native chickens. Furthermore, the native chicken population in the country is quite stagnant, its current population is estimated to be 310.521 hundred thousand birds[2]. However, the consumers of chicken meat recently prefer to choose meat from native chickens than broiler based on the taste. In addition, regarding nutritional value, local chicken carcass has a higher protein and a lower calorie and fat content than broiler carcass[3].

There are 31 breeds of native chicken identified in the country. Among them, 11 breeds are known as high egg production, 12 breeds are known as ornamental chicken and 4 breeds are broilers, while 9 breeds are nondescript type[4]. These indicate that Indonesian native chickens have a lot of diversity with different morphological characteristics, such as feather color and comb type. In order to increase the contribution of native chickens to the national poultry production and provide breed characterization, the genetic improvement strategies should be a priority. Lack of sufficient information regarding phenotypic characterization is one of the major barriers in the improvement of native chickens. Thus, the present study was conducted to characterize the phenotype of morphological qualitative traits in Indonesian native chickens with different comb types.

MATERIALS AND METHODS

Location of study area and experimental animals: A total of 40 adult male chickens made up of 4 chicken groups based on different comb types (single, pea, rose and walnut) were sampled for this study. Fig. 1 illustrates the variety of comb types. All the chickens were managed under similar production system in Gunung Kidul regency, part of Yogyakarta Special Region, Indonesia. The regency is located between latitude 7°58 0.05" S and longitude 110°36 9.22" E and categorized as a karst region. In the dry season, the region is faced with a water shortage, especially between May and October.

Measurement of qualitative morphological traits: Data on qualitative morphological traits, such as the color of the head part (beak, eye and the feather of crown and neck), body part (the feather of chest, abdomen, back, primary and secondary wings) and tail part (tail, shank and the feather of thigh) were collected. A visual observation on the tested traits of Indonesian native chickens were conducted with the same descriptor.

Statistical analysis: Descriptive statistics, such as percentages were used to analyze the data on qualitative morphological traits without application of statistical tests.

RESULTS

Table 1-3 shows the phenotypic variation of feather color for head, body and tail parts, respectively, in Indonesian native chickens. Various feather color in head part was observed in the current chicken population. In general, black is more

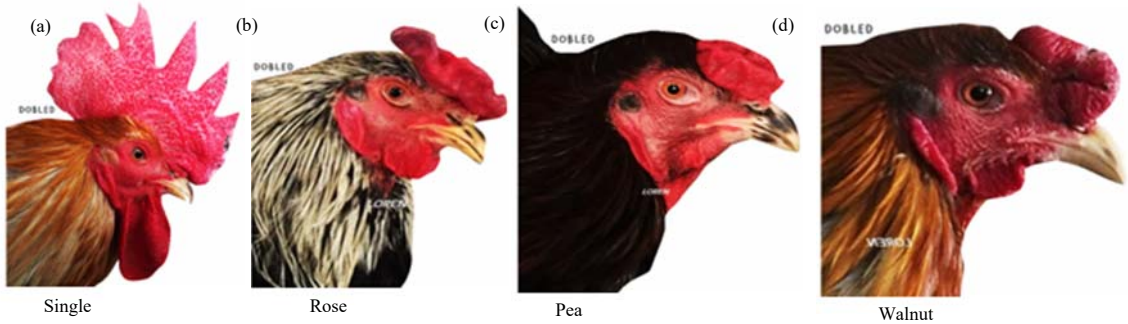

Fig. 1(a-d): Four comb types of Indonesian native chickens

Table 1: Percentages of the head part of qualitative traits in Indonesian native chicken with different comb types

Qualitative traits	Single	Pea	Rose	Walnut	Overall
Beak color					
Dark yellow	40.0	10.0	10.0	10.0	17.5
Light yellow	20.0	50.0	60.0	40.0	42.5
Pale yellow	30.0	30.0	30.0	50.0	35.0
White	10.0	10.0	0.0	0.0	5.0
Eye color					
Dark eye	100.0	100.0	100.0	100.0	100.0
Crown feather color					
Red brown	50.0	40.0	20.0	80.0	47.5
White brown	10.0	0.0	0.0	0.0	2.5
White yellow	30.0	0.0	0.0	0.0	7.5
White	10.0	10.0	0.0	0.0	5.0
Black	0.0	20.0	0.0	10.0	7.5
Yellow	0.0	30.0	30.0	10.0	17.5
Red	0.0	0.0	50.0	0.0	12.5
Neck feather color					
Red brown	50.0	40.0	10.0	60.0	40.0
White brown	10.0	0.0	0.0	0.0	2.5
White yellow	10.0	0.0	0.0	0.0	2.5
White	30.0	10.0	0.0	0.0	10.0
Black	0.0	20.0	0.0	20.0	10.0
Yellow	0.0	20.0	50.0	20.0	22.5
Red	0.0	10.0	40.0	0.0	12.5

Table 2: Percentages of the body part of qualitative traits in Indonesian native chicken with different comb types

Qualitative traits	Single	Pea	Rose	Walnut	Overall
Chest feather color					
White brown	10.0	40.0	10.0	30.0	22.5
White yellow	10.0	0.0	0.0	10.0	5.0
White	30.0	20.0	10.0	0.0	15.0
Black	50.0	20.0	10.0	40.0	30.0
Yellow	0.0	20.0	30.0	10.0	15.0
Red	0.0	0.0	40.0	10.0	12.5
Abdomen feather color					
White brown	10.0	20.0	10.0	30.0	17.5
White yellow	10.0	0.0	0.0	10.0	5.0
White	30.0	20.0	10.0	0.0	15.0
Black	50.0	40.0	10.0	40.0	35.0
Yellow	0.0	20.0	30.0	10.0	15.0
Red	0.0	0.0	40.0	10.0	12.5
Back feather color					
Red brown	30.0	20.0	0.0	40.0	22.5
White brown	10.0	0.0	0.0	0.0	2.5
White	0.0	10.0	0.0	0.0	2.5
Black	60.0	30.0	0.0	60.0	37.5
Yellow	0.0	30.0	40.0	0.0	17.5
Red	0.0	10.0	60.0	0.0	17.5
Primary wing feather color					
Red brown	30.0	20.0	0.0	0.0	12.5
White brown	10.0	0.0	0.0	30.0	10.0
Black	60.0	80.0	80.0	60.0	70.0
Red	0.0	0.0	20.0	10.0	7.5
Secondary feather color					
White	10.0	20.0	0.0	30.0	15.0
Black	90.0	70.0	60.0	60.0	70.0
Yellow	0.0	0.0	20.0	0.0	5.0
Red	0.0	10.0	20.0	10.0	10.0

Table 3: Percentages of the tail part of qualitative traits in Indonesian native chicken with different comb types

Qualitative traits	Single	Pea	Rose	Walnut	Overall
Tail feather color					
Black	40.0	30.0	40.0	30.0	35.0
Black white	30.0	20.0	50.0	60.0	40.0
Black green	20.0	40.0	10.0	10.0	20.0
White	10.0	10.0	0.0	0.0	5.0
Thigh feather color					
Black	80.0	80.0	90.0	90.0	85.0
Black green	10.0	0.0	0.0	10.0	5.0
White	10.0	20.0	10.0	0.0	10.0
Membrane shank color					
Light black	0.0	0.0	30.0	50.0	20.0
Light yellow	100.0	100.0	70.0	50.0	80.0
Shank color					
Black	0.0	20.0	30.0	40.0	22.5
Yellow	100.0	80.0	70.0	60.0	77.5

frequent than white-brown, white, yellow and red, with white-yellow and red-brown being the least frequent. Beak color varied from dark yellow, light yellow, pale-yellow to white. Dark yellow (40%), light yellow (60%) and pale-yellow (50%) were the most predominant beak color in single, rose and walnut chickens, respectively. White beak color was only present (10%) in chickens with single and pea combs. All chickens in each comb type had dark eye color. Red-brown (80%) was the most predominant color for crown feather in chickens with walnut comb. Interestingly, chickens with rose comb were commonly observed to have red-crown (50%). Red-brown color was the most prevalent for neck feather among chickens group (40%).

Various feather color was also observed in body part (Fig. 2, 3). The most frequent chest feather color in chickens with single and walnut combs were black, with percentages of 50 and 40%, respectively. Chickens with pea and rose comb were mostly white-brown (40%) and red (40%) for their chest feather. For abdomen feather color, chickens with single, pea and walnut combs were mostly black, with percentages of 50, 40 and 40%, respectively, while chickens with rose comb were mostly red, with percentage of 40%. The predominant feather color in both primary and secondary wings were black in all chicken groups.

For the tail part, feather color varied among chicken groups (Fig. 4). Black was the most predominant color (40%) in chickens with single comb. Black and black-white were the most frequent color for tail feather in chickens with rose and walnut combs, with percentages of 50 and 60%, respectively. For thigh feather, black was the most predominant color, followed by white and black green in all chicken groups. Light yellow was the most frequent color in all chicken groups, while light black was the least frequent color. For shank color, the most predominant color was yellow, whereas black was the least frequent color in all chicken groups.

DISCUSSION

This study attempts to provide a brief description of Indonesian native chickens based on qualitative morphological characteristics. In this study, a wide variation of plumage color of Indonesian native chickens indicated the presence of a phenotypic variability. In the current study, morphological characteristics of the tested chicken population were observed into three parts, including head, body and tail.

The findings of the present study are comparable with the reports of several studies in Indonesian native chickens[5-7]. The findings of Nataamijaya[5] indicated that 80% of the Pelung chickens of Indonesia were characterized by black, followed by white (20%) for the beak color. In contrast, the same author also reported that white was the most predominant beak color in Sentul chickens. Rusdin *et al.*[6] reported an absence of white for the plumage color of Tolaki chickens and all observed chickens had multicolored for their plumage. The findings of Hidayat *et al.*[7] revealed that red-brown was the predominant plumage color in Merawang chickens, with an absence of white, which was similar with the results of the present study. Rusdin *et al.*[6] reported that 67% for the shanks color of the Tolaki chickens of Indonesia were black, followed by yellow (33%). In the current study, yellow was the most prevalent color for the shank, followed by black, which concurred with the findings of Hidayat *et al.*[7] in Merawang chickens of Indonesia. Similarly, yellow was the most predominant color for the shank in indigenous chicken populations from Ethiopia and Nigeria[8-10]. Yellow is attributed to the dietary carotenoid pigments in the epidermis when melanic pigment is absent,

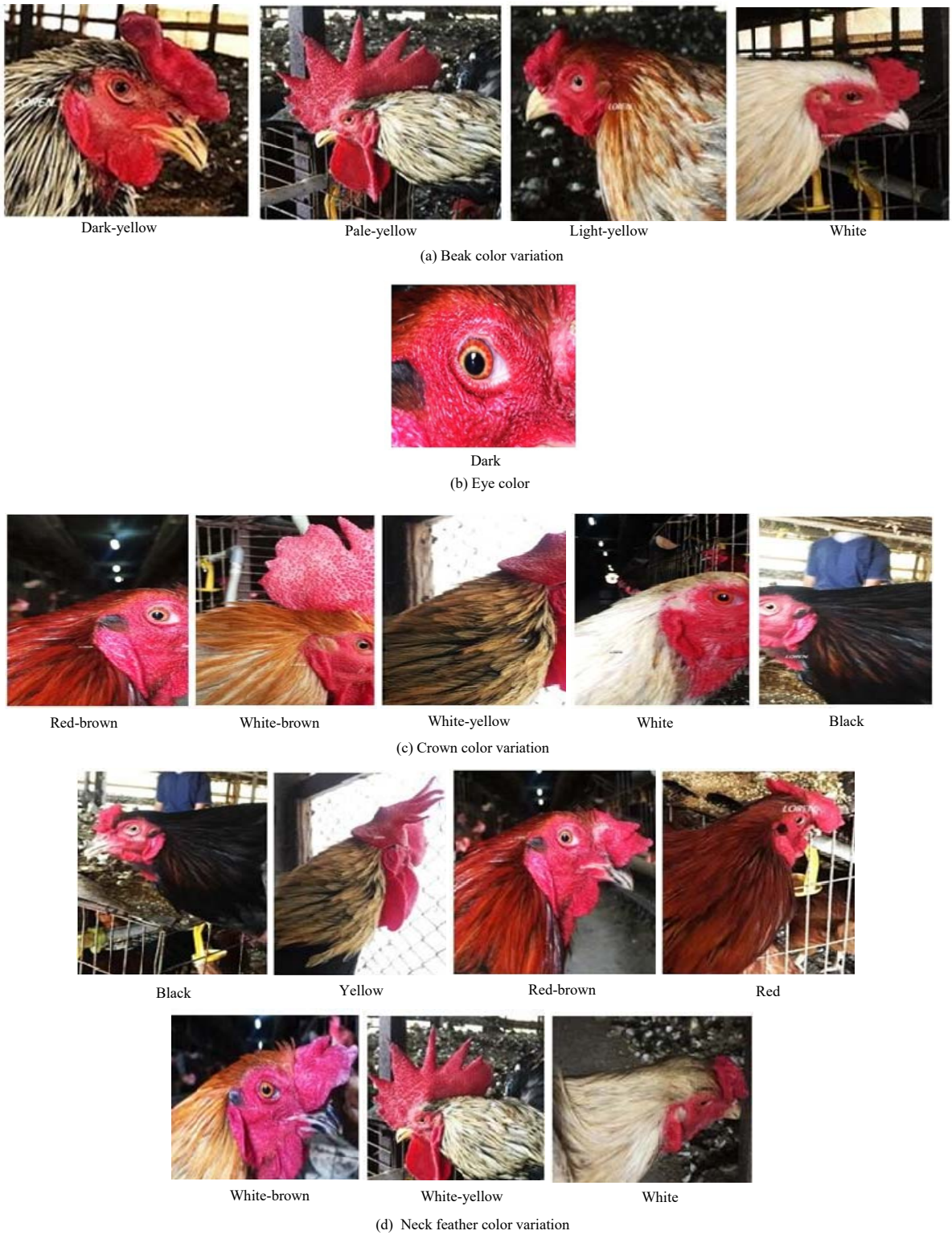

Fig. 2 (a-d): Phenotypic variation for the head parts in Indonesian native chickens. (a) Beak color variation: Dark-yellow, pale-yellow, light-yellow and white; (b) Eye color: Dark; (c) Crown color variation: Red-brown, white brown, white-yellow, white and black; (d) Neck feather color variation: Black, yellow, red-brown, red, white-brown, white yellow and white

(a) Wings feather color variation

(b) Back feather color variation

Fig. 3 (a-b): Phenotypic variation for the body parts in Indonesian native chickens. (a) Wings feather color variation: Black, yellow, red-brown, white-brown and white; (b) Back feather color variation: Red-brown, red, white-brown, white-yellow, yellow, black and white

while black is the result of melanic pigment in the dermis and epidermis[11]. When the black pigment is present in dermis and yellow in epidermis, the shanks will be greenish. However, when both of these pigments are absent, the shank will be white.

The current findings of dark eye color in all the investigated chickens concurred with the findings of Rajkumar *et al.*[12] and Negassa *et al.*[13], who reported black as the most frequent color in Aseel chickens from India and indigenous chicken populations from Ethiopia, respectively. Contradicts with our findings, Guni and Katule[14] reported orange as the most prevalent for eye color among indigenous chickens of Nigeria and Tanzania. However, the eye color observed from the current study could not be compared among Indonesian chickens because lack of literature regarding this trait.

(a) Tail feather color variation

(b) Shank feather color variation

Fig. 4 (a-b): Phenotypic variation for the tail feather and shank color in Indonesian native chickens. (a) Tail feather color variation: Black-green, black-white, black and white; (b) Shank feather color variation: Black and white

The various morphological characteristics of the Indonesian native chickens were observed in the current study. Among the chicken groups, variation in the color of each qualitative trait was identified. This variation may be due to differences of the chicken's genetic make-up and the environment plays a crucial role in the differences in phenotypic appearance of the chickens. Duguma[15] and Ngeno *et al.*[16] reported that the comb types were significantly affected by geographical and environmental conditions, which contradicted with the findings of Moraa *et al.*[17], who revealed no significant relationship between the comb type and the outside temperature. In case of our study, all tested chickens were managed under similar geographical, feeding and production system. The possible reason of differences in the phenotypic appearance was due to differences of the chicken's genotype. Since the native chickens provide a vital contribution to Indonesian households, assessing the genotype and documenting the morphological traits are of great interest.

CONCLUSION

Indonesian native chickens are characterized by a number of color variants, which could be important for the genetic improvement and breeding strategies. The future efforts are addressed to improve the productivity of native chickens. Hence, in-depth works involving morphometrics, production, growth and molecular characterization in large sample size and chicken breeds need to be carried out for appropriate improvement and utilization of the native chickens of Indonesia.

SIGNIFICANCE STATEMENT

This study discovers the considerable phenotypic diversity of Indonesian native chickens that can be beneficial for genetic improvement and breeding strategies. This study will help the researchers, breeders and policy makers to design a proper utilization of native chickens by understanding the phenotypic characteristics and diversity that many researchers could not explore. Thus, a new approach on the wise management of a local genetic resource may be developed.

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